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Machining Duralumin Connecting-Rods

By FRED H. COLVIN
Editor, *American Machinist*

Coining to size for grinding — Drilling, reaming and broaching operations — Inserting and swaging babbitt bearings—Boring the large ends for selective assembly

THE PRESENT tendency toward lightening the parts which go into an automobile has long been one of the tenets of the engineers of the Franklin Motor Car Co., who probably study the question of weight more closely than the engineers of any other organization. In the present Series 10 motor, there has been adopted for the first time, the aluminum alloy known as duralumin, for the connecting rods, so as to reduce the weight of the reciprocating parts and, incidentally, the weight of the whole motor. While the effect of this lightening of parts on motor performance is an interesting study, our problem is to note the changes, if any, in the machining of duralumin rods from that pursued when steel was used. There can be no doubt that we shall see a much greater use of the lighter alloys, not only in motor cars, but in machine construction generally, and it behooves us to become acquainted with their machining qualities as well as their other characteristics.

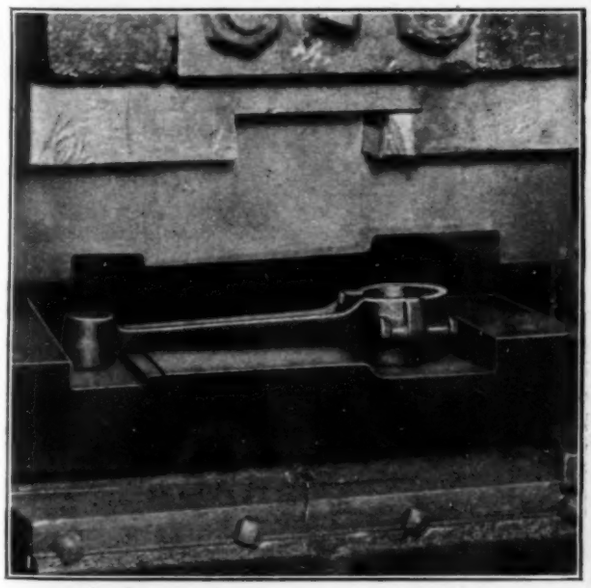
The rods are of forged metal and come very uniform in size, the same as any good drop forging. The cap is forged with the rod as can be seen in Fig. 1 which shows the first operation, that of "coining" or cold forging the ends to the proper thickness to allow for the grinding operation which follows. This coining leaves from 0.015 to 0.020 in. on each side.

The rods are ground on a Blanchard machine, the table being fitted to hold 20 rods at one setting. The fixture is so arranged that 10 rods are ground on the first side while the other 10 are being finished. The rods ground on one side are then reversed and a new batch of 10 rough rods put on for the first grinding. In this way 10 finished rods are taken off the machine at each loading period. The wheel spindle runs 850 r.p.m. and the feed is 0.002 in. per rev. of the 40-in. work table, which turns 14 r.p.m.

Drilling the Ends

The special geared-head drilling machine for drilling both ends of the rods at the same time is shown in Fig. 2 and has a cam feed of 2¼ in. per min. for all the drills. The large hole is a trifle over 2 in. in diameter and is drilled at 134 r.p.m., being also semi-finish reamed at the same speed. The finish reamer, however, only runs at 54 r.p.m. The small hole is drilled $\frac{5}{8}$ in. at 300 r.p.m. and then semi-finish reamed to 0.857 in. at 116 r.p.m.

The three large spindles on the outside carry the



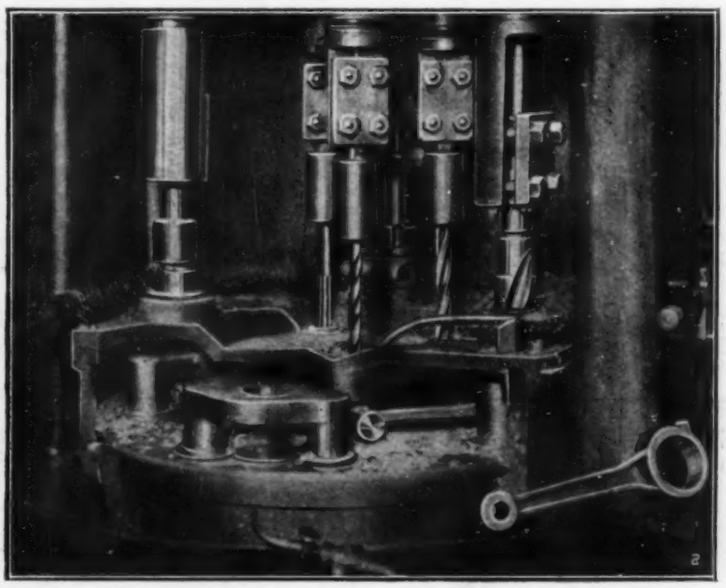
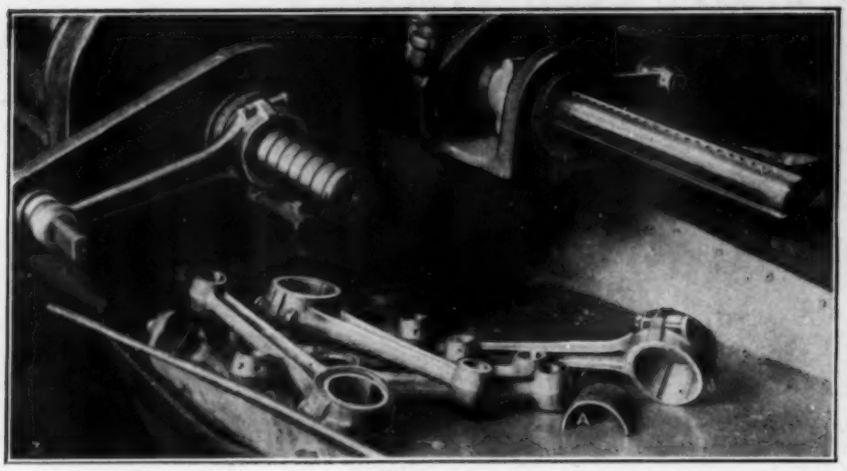


FIG. 1—COINING A ROD BEFORE GRINDING. FIG. 2—DRILLING AND REAMING BOTH ENDS



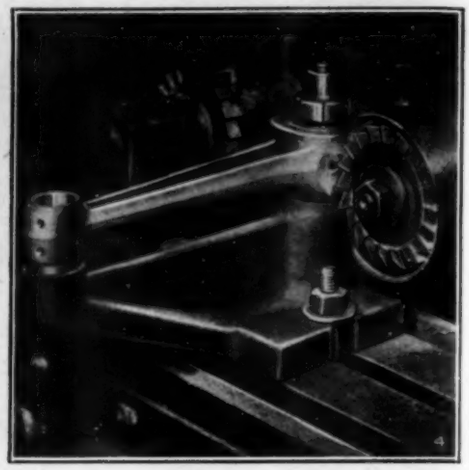


FIG. 3—BROACHING AND SWAGING THE BEARINGS. FIG. 4—SPOTTING FOR BOLT HEADS

tools for the large ends of the rods while the central group of three spindles carry the tools for the small ends. A feature of the machine is the way in which the drills and reamers are held in the spindles. Plain and substantial plates or straps, with four bolts, hold the tools firmly in place.

The next two machining operations are done on the double-spindle broaching machine seen in Fig. 3. At the right is the broach for broaching the grooves for holding the babbitt shells in the large ends of the rods. The broach with its inserted cutters and the grooves they cut can be seen in Fig. 3. The broaching speed is 6 ft. per minute.

The babbitt shells are inserted in a hand arbor press and the rods are then ready for swaging the shells into place and sizing them for the final reaming. One of the shells is shown at *A*, Fig. 3. The swaging operation is done on the left hand spindle of the double broaching machine, the bar carrying a swage instead of a broach. The speed is 6 ft. per min. Swaging makes the holes 1.960, leaving 0.040 in. for boring and reaming.

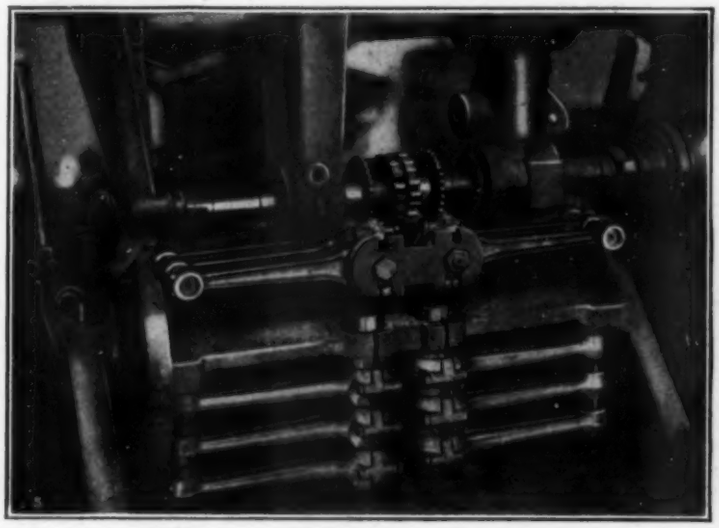
Bolt holes are next drilled and reamed in a special machine of the cluster head type, the 25/64 in. drills running at 620 r.p.m. with a feed of 2½ in. per min. The reamers follow at the same speed and feed, enlarging the holes to 0.375 in.

Spot milling for the bolt heads on the connecting-rod lugs is done in a special fixture mounted on a hand milling machine as shown in Fig. 4. The fixture locates the rods by means of studs in both holes. The milling is done by moving the table first in one direction and then the other, stops being provided to limit the movement.

In the next operation the nut faces on the caps are milled and the caps separated from the rods. This is done in a special fixture mounted on a knee-type milling machine as shown in Fig. 5. The revolving fixture has four faces and carries 6 rods on each face. The side milling cutters are 3½x½ in. and the slitting saws 3½x⅛ in. The milling cutters run at 68 r.p.m. with a feed of 5 in. per minute.

After milling one side, the rods are transferred to the other side of the same face of the fixture and are then in position for the final separation of the cap. The fixture is conveniently arranged for changing rods by means of slotted washers which clamp the large ends firmly during the milling operations. The large index plate at the end of the fixture is provided with hardened steel notches.

Finish reaming the small hole is done under an upright drilling machine in the fixture shown in Fig. 6, the reamer being guided by the screw bushing shown with the handle set at an angle. The reamer is 0.847 in. which leaves 0.0005 in. for burnishing. The piston pin floats in the rod and bears directly on the



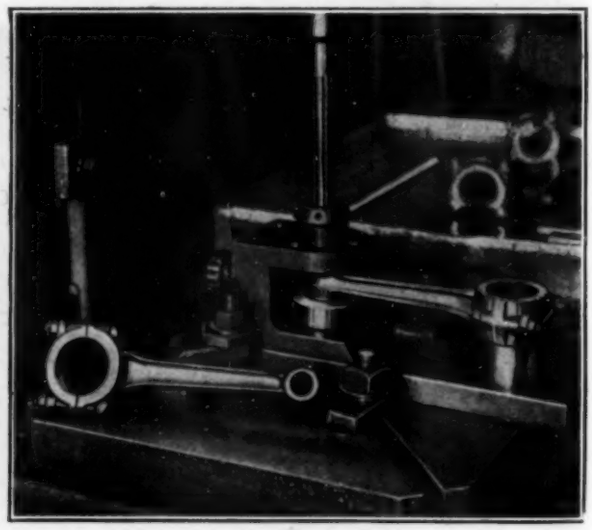


FIG. 5—SPLITTING THE CAPS FROM THE RODS. FIG. 6—REAMING THE PISTON-PIN HOLE

duralumin, which, contrary to former ideas, makes an excellent bearing. The reaming is done at 310 r.p.m. and a feed of 2½ in. per minute. The hole is then burnished to 0.8745 in. at a feed of 5 in. per min., the burnisher running 250 r.p.m.

The final operation on the connecting rods is done in the assembling department where the large ends are bored to the proper size for the crankpins they are to fit. This operation, shown in Fig. 7, also insures alignment between the two holes and avoids the necessity of any straightening operation. The bar *A* is slipped through the piston-pin hole until the collar bears against the end. Then the rod with the test bar is placed in the bearings shown which locate the rod at right angles to the piston-pin hole. The large end is suitably supported against any thrust from boring and the rod bored to fit the pin with a suitable allowance for lubrication. A number of boring bars are provided, having cutters with small variations in

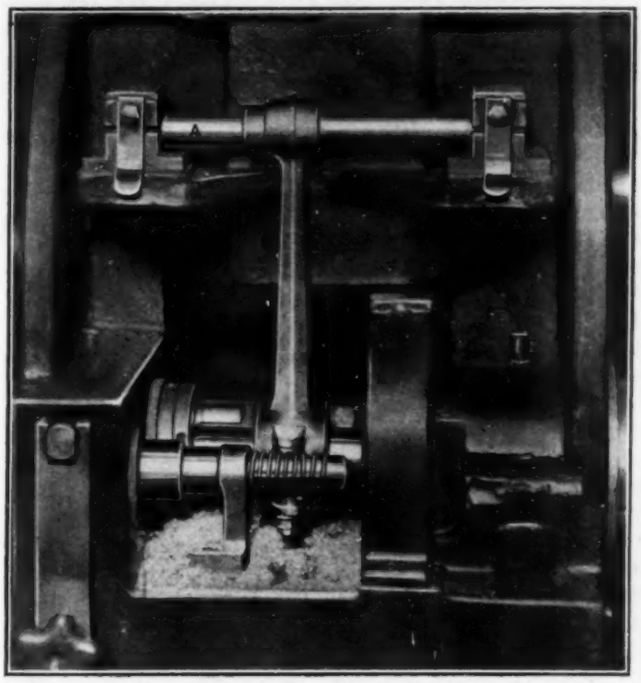


FIG. 7—BORING LARGE END TO FIT CRANKPIN

diameter, so that after measuring the crankpin it is an easy matter to select the proper bar. The bar runs at 226 r.p.m. and has a feed of 1⅞ in. per min. There is no hand fitting in the sense of scraping the holes, but the greatest care is taken to secure the most accurate machine work.

Departure from Strict Interchangeability

While strictly speaking, this boring each rod to suit the particular crankpin on which it is to run, is not absolutely interchangeable manufacture, it nevertheless represents the best practice of the day where a high grade product is desired. While absolute interchangeability can be maintained, if we are willing to pay the price, it is generally conceded to be unnecessary and unwise on such parts as are subject to constant wear and which could not be replaced with pieces of standard size. Selective assembly on such parts is generally conceded to be better from a practical point of view, where the best product is to be placed in the hands of the customer at a fair price.

Six Ways of Securing Co-operation and Interest from Your Men—Discussion

By John Thomas

The article under the above title by E. O. Kuendig on page 680, Vol. 57 of the *American Machinist*, seems to cover the subject rather better than anything the writer has ever read before and if carried out will surely bring the desired result. However, the writer has never in a long experience in shop and office, come in contact with these principles in actual use. The difficulty seems to be in finding men fitted to carry them out.

Loyalty and co-operation seem to be things which are affected very little by money alone, there are other things which count much more. These points are all covered in Mr. Kuendig's article.

Satisfied but Not Loyal

It is possible that a man may be satisfied with his wages and yet feel like "cursing" the firm he is with. Such a condition can arise from only one source—his contact with those in authority. First, of course, comes the foreman, and in so far as the average workman is concerned the foreman is the firm. It is easily within the power of the foreman to inspire loyalty or the opposite more than is possible for any other one representative of the firm. He can make things easy and pleasant for the workman or he can if he chooses, just as easily make himself and his firm the most hated.

In the opinion of the writer absolute justice in everything will satisfy most men. This means that a man should be treated as Mr. Kuendig suggests. If there is a wage shortage, remedy the matter at once, do not expect a man to wait in good humor until next payday for what was due his last payday; far better send a messenger from the paymaster's office with the shortage and hand it to the workman in the shop; that will at least appear as though the firm was anxious to make things right.

Method in Setting Piece Rates

As to setting piece rates; first of all the rate setter should be able to use a little common sense along with his work and also to get the workman's point of view. When a rate is set let it be a plain business proposition, to be talked over by both interested parties. We all know how much say the workman has in the average shop. The idea that the only way to set a rate is to sneak up behind a column with a stop watch and then sneak back into the office and try to figure the thing out is just plain bull. Co-operation is not built up by underhand methods.

Another big dividend payer in the matter of loyalty is the practice of the men higher up speaking to the men in the shop as they pass through. Some never see the shop for weeks on end and when they do go through seem to be more interested in something fifty feet ahead than anything near at hand. Many big men seem to think that it pays to know as many of their men as possible. It may not be necessary to stop and speak to everyone but it is a good idea to speak to one or two each trip and not necessarily the same ones. Others may be recognized by a nod. If a man can be made to feel that both the higher ups and himself are working for the same firm, or as someone else has said it better, that he is working with you instead of for you, co-operation will surely result.

Sympathy Running Riot

By A. L. DeLeeuw
Consulting Editor, *American Machinist*

TO SYMPATHIZE with a horse because it cannot fly or with a robin because it cannot pull a buggy is nonsense pure and simple and recognized as such by anyone who lays claim to a place outside of the insane asylum. And yet the world is overflowing now-a-days with the tears shed by softhearted people when they contemplate the terrible lot of many workers, who see their intellectual and spiritual life ebbing away while earning a bare living by doing drudgery and repetition tasks.

They do not recognize the fact that the overwhelming majority of people engaged in such tasks are doing the only kind of work for which they are fitted.

They all seem to go out from the supposition that all human beings are created alike. They are willing to make allowance for small differences in height, weight, color and complexion, and, when hard pressed, they admit grudgingly that one person may perhaps be a little brighter than another; but when it comes to the true inner life, all men are equal.

Now there never was a fallacy so complete as the idea that men are born equal. It would be very nearly, if not entirely, correct to say that no two persons are born equal; that they are unlike in every respect, in physique, in intellect, in sensitiveness, in actions and in resistance. To build a theory on the idea of universal inequality may lead somewhere; to ignore it can only confuse and befuddle people who have not the brains or the time to look into things for themselves.

The sympathetic writer sees civilization going to smash and the moral and intellectual texture of the worker disintegrating on account of more and more automatic and semi-automatic machinery. He sees the human being reduced to a mere piece of machinery and makes you believe that a large part of the race is selling its soul for a mess of pottage—a very small mess at that. He tells you that if a man works *many* hours a day at repetition work his spirit is dulled, his ambition killed and that shortly he is reduced to a mere semblance of a human. If on the other hand he works but *few* hours a day, he spends the rest of the time cooking up mischief in an unconscious effort to counteract the deadening effect of his labor. He makes you feel that the life of such workers is a tragedy and he words it so that you believe that all of the present day industry of the world consists of such deadening tasks.

Men on the Job Too Busy to Write

Unfortunately those people who have had an opportunity to study the conditions prevailing in industry, the men whose business it is to watch the workers and obtain their best efforts—never mind whether they are selfish or not while doing it—the men who must hire and fire and change and promote are men who, as a rule, have neither the gift of gab nor of the pen and therefore the statements of well-meaning and well-writing but ignorant folks are left unchallenged.

It would seem to be about time to call attention to the fact that humanity consists of a great variety of specimens and kinds; that there are some whose strength lies in their brains, others who have only the power of their muscles to give to the world, still others who are not gifted either way but who have willingness and may have many desirable gifts of character which will make them as good citizens as professors or longshoremen. It is this latter class of people with neither great strength of muscle or brains who most frequently have fallen by the wayside in former years and who were the hopelessly poor. Present day industry has provided this class of people with a means by which they can earn a livelihood in an honorable way without killing themselves by work for which they are not fitted and it has done so by providing automatic machines. The automatic machine, simply because it is a machine, furnishes the power and because it is automatic it furnishes the brains required for certain kinds of work.

Tragedy of the Misfit Worker

One of the greatest tragedies in life is the tragedy of a man working at a task for which he is not fitted. Whether the professor in logic is digging for foundations or whether the professional trench digger is set to the task of logical reasoning makes no difference. Both men will be unhappy because the work they are to do is not in accord with their gifts. That there are some people at the present time, too many in fact, who are working at tasks for which they are not fitted is perfectly true but this is as much the case with work in which no automatic machines are employed as with the much discussed repetition tasks. Industrial managers who are alive to their problems try to avoid this condition as much as possible. That they are not always successful is to be regretted but in no way can it be said that the condition is the result of automatic machinery. What we need is more complete guidance of the young man or woman in the selection of a career. Even then, when we do all that human beings can do, there still will be cases where the worker does not agree with his work.

To say that the repetition work causes a man to seek mischief in his idle hours is rank nonsense. This sort of men can be found in any occupation. That such conduct is fostered by the fact that the man has been unhappy doing his work is true but he has not been unhappy because his work was repetition work but merely because he was not fitted for that task. We will find many a clerk or tool maker or machinist or blacksmith going off on a tangent just as the repetition worker does occasionally and mostly because the work he has been doing has been repugnant to him, or else because either character or training are lacking. If we were able to place every man where he belongs much trouble in this world would be avoided.

Some of the writers of these tales of woe have tried to prepare themselves by doing the work of the man whose life they try to analyze, at least for a few days or a few weeks and invariably they find it very hard. We do not doubt this. A man who has had a college education, who has lived in refined surroundings, who has enjoyed the companionship of cultured people must certainly feel very unhappy when he is suddenly placed in surroundings which are natural to the man who has had no education or culture and has been doing rough work from childhood. We dare say that if the coal miner were made to live the life of the refined cultured man of science he would not only feel very unhappy but he either would bolt or else become insane. The educated man feels differently and much more strongly than the man whose work brings him close to nature. Set the gage maker to carrying molds in the foundry and to pouring and he'll pray nightly for deliverance; set the brawny molder to measuring to a tenth of a thousandth and he'll die of nervous breakdown.

Burnishing the Teeth of Gears

By ELLSWORTH SHELDON
New England Editor, *American Machinist*

Corrects minor errors of contour—Smooths and densifies tooth surface—Analogous to cold hammering—Forestalls effects of distortion in hardening

IN COMMERCIAL production of gears that require more than ordinary accuracy in the matter of tooth contour the result is usually a sort of compromise between the degree of perfection desirable to accomplish the purpose for which the gears are intended and the cost of attaining it. Rarely are the conditions under which the gears are to be run so exacting as to exclude consideration of manufacturing costs. The burnishing process here described is intended to enhance the quality of the product without proportionately increasing its cost.

To such a state of refinement has our present-day gear-making machinery arrived that we can now produce unhardened gears so closely approximating theoretical exactness as to meet the requirements of nearly all mechanisms of which gears are a component. There are, however, some mechanisms—notably automobile transmissions—in which commercially cut gears, though answering every demand in the way of perfection of spacing and contour, do not possess sufficient physical strength to withstand the severe usage to which they are subjected, and heat-treated gears are therefore necessary.

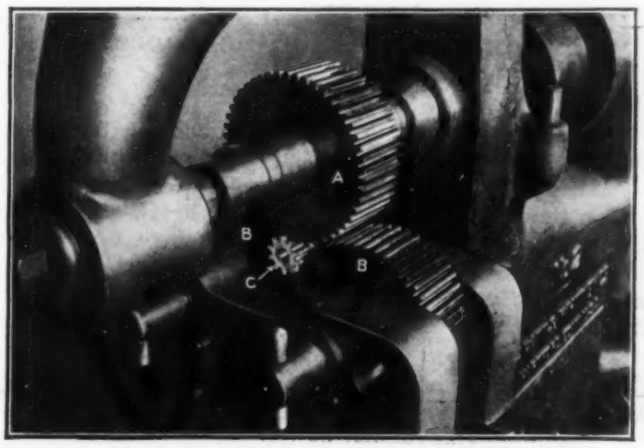
However accurate the unhardened gear, it cannot be expected to hold its perfection through the hardening process. The most noticeable, and at the same time most uniform distortion due to the heat-treatment, is the apparent swelling of the tooth which seems to become thicker at the top with little or no change at the root. This is a condition logically to be expected, as the root of the tooth is tied by the adjacent body of metal in the gear while the top is more or less free to expand.

Forestalling the Effect of Hardening Errors

Whatever the cause, the result is a departure from true normal pitch in the shape of a distorted involute, and the additional thickness at the top of the tooth causes "edge" interference with the flanks of the mating gear so that a noisy pair is inevitable. To forestall this result, a burnishing process, applicable to the gears before hardening, has been developed by the Pratt & Whitney Co. for the purpose of modifying the tooth curves by "topping" or thinning the point of the tooth a definite amount, with the effect that the change in shape due to hardening acts in a measure to restore the contour to its original condition, but in any event prevents the end of the tooth from becoming sufficiently prominent to cause edge interference.

As the process has but recently passed the experimental stage, there has been no special machine built for the purpose as yet. The burnishing fixture shown in the illustration is mounted upon the table of a milling machine with the driving burnisher *A* secured upon the arbor thereof. Parts *B*, *B* are carried by short removable shafts passing through the sides of the fixture and provided with ample oil channels in order that they may be thoroughly lubricated and in condition to turn freely when the burnishing pressure is applied by raising the knee of the machine.

The driving burnisher *A* is of the same normal pitch as is desired in the burnished gear. The lower burnishers *B*, *B* are alike, and differ from burnisher *A* only in respect to their normal pitch, which is definitely shorter than the desired normal pitch of the gear to be burnished, by an amount that may depend somewhat upon the nature of the material of which the latter is made and also to some extent upon the subsequent heat-treatment to which it is to be subjected. All three of the burnishers are hardened and are finished upon gear-tooth grinding machines to a high degree of accuracy.



THE GEAR BURNISHING FIXTURE

Burnishing the Gears

To burnish a gear, the latter is set in place as at *C*, where it is in mesh with all three of the burnishers but is not independently supported. The knee of the milling machine is then raised until the gear *C* is in firm metal to metal contact with the burnishers, when the machine is started and allowed to run for a period of five or six seconds while the knee of the machine is gradually raised to bring an increasing pressure upon the tooth surfaces. The speed of the driving

burnisher may range from 200 to 400 r.p.m., according to the diameter of the gear undergoing treatment.

It is obvious that the burnisher *A* will mesh correctly with the unhardened gear, and that because of the pressure the hardened teeth of the burnisher will exercise a rubbing or burnishing action upon the surfaces of the soft teeth; this action extending over the full working depth. On the other hand, the two lower burnishers, because of their shortened normal pitch, will bear at first only upon the edges or corners of the soft teeth of the gear to be burnished.

The result of the continued application of pressure is to thus squeeze the metal of the soft teeth and cause it to flow slightly upon itself. Throughout the greater part of the tooth contour the effect is to produce a smooth and dense surface without in any way altering the form. For a short distance from the end of each tooth, however, there is a distinct modification of the curves by reason of the tendency of the soft teeth to conform to the shape of the burnishers of shorter normal pitch.

The contour of the burnished teeth thus becomes a somewhat modified involute, the extreme outer end of which conforms to the involute of the lower burnishers and blends smoothly into the curve that results from contact with the upper burnisher. The actual modification is necessarily slight, the amount having been found by experiment to be just sufficient to relieve the edge interference that is a prolific source of noise.

The modification may be increased or diminished by exchanging the lower burnishers for others having shorter or longer pitch respectively. It would at first appear that the amount of modification could also be varied by varying the pressure or time of contact, but it has been found that the full amount of modification attainable is secured in the first five seconds of contact, and the attempt to carry it further will result only in roughening or abrading the tooth surfaces.

The same process is applied to gears that are not to be hardened with the difference that the burnishers *B*, *B* are removed and a pair having correct normal pitch (duplicates of *A*) substituted for them. The burnishing is analogous to cold-hammering, or swaging, and imparts to the teeth of an unhardened gear a smooth wear-resisting surface that is claimed to add 50 per cent to the life of the gear. Its effect upon gears that are to be hardened is not only to nullify the distortion attendant upon the hardening and cause the teeth to conform more nearly to theoretical exactness, but the burnished surfaces seem to have the property of resisting the pitting and corrosive action of the fire so that any scale that may be formed is easily brushed off, leaving a smooth and unimpaired tooth surface.

A Few Suggestions for the Apprentice

By H. L. Wheeler

Youth is ever prone to ignore the advice of its elders, perhaps because advice is about the cheapest thing in the world. It may be good or bad advice, but seldom will men who hold your interests at heart offer anything but good advice for you to follow. When a man reaches the fortieth milestone of life he looks back and thinks what might have been had he followed so-and-so's advice when he was twenty.

The young men who are now working to become first-class machinists or tool makers will find the following suggestions of real value in many ways. Some are simply maxims as old as the pyramids, and others are rules of conduct that if followed faithfully will bring you safely to the port of your heart's desire.

Get the habit of being neat and clean about everything concerning your work. Wear a suit of overalls or apron. Do not wear loose-fitting garments or long sleeves unless they are buttoned tightly about the wrist; roll the sleeves up above the elbows, or better, have them cut off short. Loose sleeves have caused many a broken arm. Never place your hand near a revolving cutter to brush away chips, but use a soft wood stick or brush or stop the machine. Avoid all kind of horseplay in the shop, as it is a dangerous practice and many a life cripple begins his career in this way. Always make use of any safety devices provided by the shops. Especially is it dangerous to run an abrasive wheel or grindstone with the guard removed.

The tools and machines that you use while in the shop are expensive, many of them very expensive, and for this reason they should be properly handled and taken care of. If you had to buy these tools yourself, most likely you would have a great deal more regard for them. Oil your machine each morning before starting up, unless a regular oiler is employed for this purpose. Never place files, heavy wrenches and tools or rough castings on the ways of a lathe, not even an old lathe. When using a toolpost grinder always protect the ways and bearings from the grit that comes from the wheel, by the use of a newspaper or cloth spread under the wheel. Never use a monkey wrench in place of a toolpost wrench or milling machine vise handle, this practice in a short time ruins the screw.

Do not try to shift gears or to set the stroke of a planer or shaper, with the machine running. It takes a trifle longer to stop the machine before making the change, but it is always wise to play safe. Get the proper speed and feed for every operation and don't be afraid that you will work yourself out of a job, as it is likely that another one is waiting for you. Machines do not get tired, and if you work with your head you can make the machine do the physical work. It is rarely necessary to use back gears for turning or milling brass and other soft metals. A good method to use in finding the proper speed and feed is to give the machine all it will stand without burning the tool. See that all belts are properly tightened and that the tools are properly hardened.

Learn the value of trifles and never slight a job no matter how insignificant it may seem to you. Always endeavor to do every job as well as you know how. If the boss should be temporarily embarrassed to find a job for you, he may tell you to sweep the floor or clean up some machines. Do not let this hurt your pride. Go at it with vim and a smile, and if you do the sweeping and cleaning well, you'll make a hit with the boss. But if you go at it with a grouch or show jealousy as to what some other boy may be doing, your future will be most unpleasant. Life's pathway is not strewn with roses, and the earlier you recognize this the more advantage you can take of future opportunities. Pay no attention to what the other fellow is doing. Concentrate on the task in hand and above all do not watch the clock.

How Two German Shipyards Are Getting Through the Peace

BY HENRY OBERMEYER AND ARTHUR L. GREENE

Machine manufacturers suspicious of visitors — Ships and locomotives — What has happened to the submarine engines—How the workmen get their wage readjustments

TWO PRINCIPAL handicaps confront the writer on industrial conditions in Germany today. One is the fact that nothing is ever forty-eight hours quite the same. The other is the still general belief among German business men that their country is beset by an iron ring of enemies. Among the more enlightened influences of the seaports and the occupied territories this attitude is not so pronounced. In some of the inland cities, such as Hanover, the suspicion of foreigners and their motives is extremely acute and is growing steadily. As a business policy, of course, nothing could be more impolitic, and the best of the German manufacturers realize the folly of such an attitude.

It must be said on behalf of the others, however, that they are not without grounds for their position. Ever since the war machine manufacturers in Germany have been bothered by visitations—in the plague meaning of the word—from official, unofficial and semi-official delegations of other countries, singly and in groups, armed *cap-à-pied* with notebooks, spectacles and an increasing disposition to ask pointed questions of an exact statistical nature.

The assumption at first was that such inquiries would lead, by direct or devious routes, to substantial orders. When these hopes failed to materialize, manufacturers ascribed to these visits more sinister motives, perhaps, than the facts warranted. The word that sprung up to describe them was *handelespionage*, commercial spying. Result: that where information is at all obtainable it must be ferreted and dragged from reluctant lips and afterward pieced together to form a plausible pattern.

So common is this experience in other machine factories that one meets its opposite with surprise in talking with manufacturers of ship machinery. Their frankness is disarming. Apparently they have no secrets. This is partly because shipbuilding is one of the most flourishing industries in Germany today and has almost no foreign competition; and partly because the very nature of the business, bringing the manufacturers into constant relation with other nationalities, begets a certain breadth of view which removes its possessor far from the ranks of the recluse.

VISITS MEAN NOTHING

And yet even shipbuilding has its *handelespionage*. At the Actien-Gesellschaft "Weser" in Bremen we were told that fifty Japanese business men had visited the factory since the first of the year; and that not a single order had been received from them, then or later. An American manufacturer would not necessarily consider this extraordinary. But it has affected the German mentality widely. Almost alone, the manufacturers of ship machinery have not permitted it to interfere with the amenities of business.

The prosperity of German ship builders is not a little remarkable. It is true, of course, that Germany still has an enormous gap to fill where she was deprived of much of her shipping after the war. This deprivation —the results of which have been keeping the ship builders busy since 1918—was not an unmixed evil.

FIG. 1—AIRPLANE VIEW OF THE VULCAN-WERKE, HAMBURG

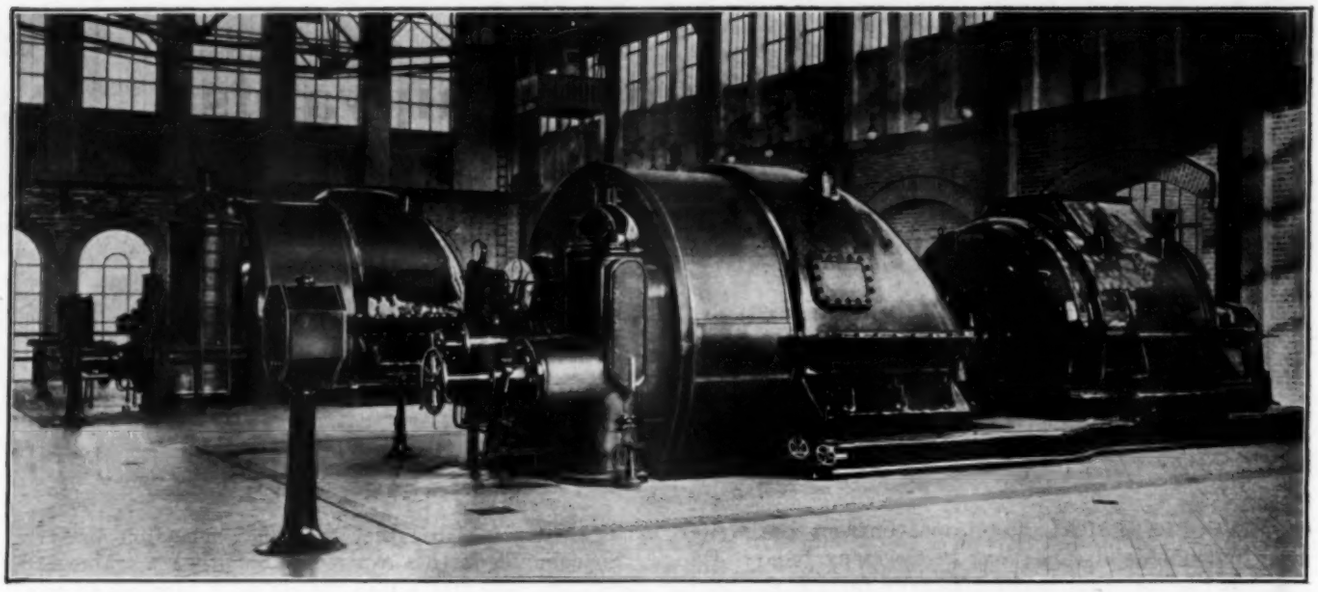


FIG. 2—THE POWER STATION AT THE VULCAN-WERKE, HAMBURG

Quoting Herr Stahl, director of the famous Vulcan-Werke of Hamburg and Stettin:

"It has enabled Germany to unload many of her obsolete merchant vessels on the Allies and build the nucleus of a fleet that is modern in every particular."

The Treaty of Versailles also helped by requiring reparations in kind, although the item of ships was comparatively small. German ship builders would like to see the treaty amended to include at least 200,000 tons a year as reparations from the German yards—a forlorn hope, of course, while the shipbuilding slump in England and especially France continues.

Against these apparent advantages, however, must be set the fact that German shipping lines have little if any money today to pay for new construction, while prices continue to advance as they do. Nor can the amount of activity required to restore Germany's merchant marine, however great, approximate the volume of shipbuilding turned out for the German navy during the war and immediately preceding that great conflict.

But one does not compare the present with before-the-war Germany, for all standards have been crushed under the leaden fall of the mark. Ship builders are content to say that they have enough orders to keep them going for the present. They add, however, that there have been few if any new contracts recently, and that there are apparently none in the offing.

Such statements have become quite familiar this year to those engaged in interviewing German business men. The future is viewed with unrelieved pessimism, even though the present industrial condition is far from being as bad as German manufacturers would like one to think. Standards are low, poverty is everywhere and comforts are few. But it is a fact, at any rate, that Germany lacks one misery which France and England especially are experiencing more acutely, according to the figures. That is to say, large scale unemployment. One points out this fact at every available opportunity,

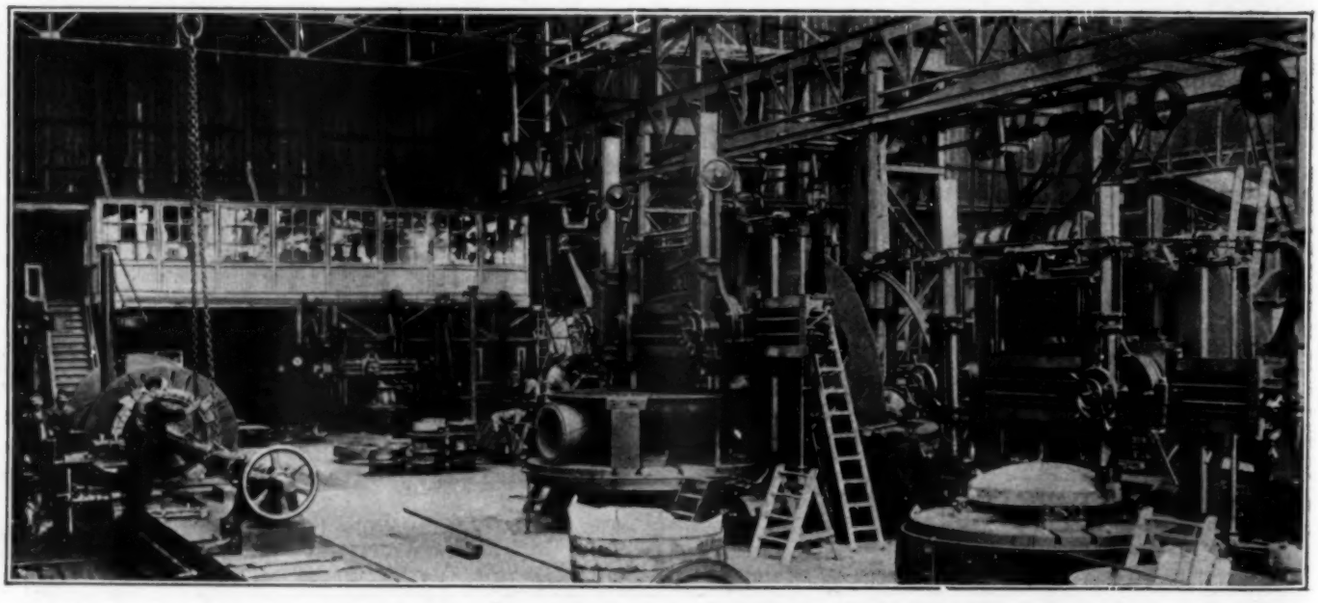


FIG. 3—AT THE WESER WORKS. FOURTEEN VESSELS OF THE FIRST CLASS ARE UNDER CONSTRUCTION AT THIS PLANT

but the invariable response is: "That will come as well." Indeed, if the mark suddenly rises, a widespread industrial slump will be inevitable.

Backing up his pessimism, Herr Neef of the Weser company produced figures showing that 3,000 workers had been dismissed there—mostly communists and other brands of radicals—since the strike of 1921, and added that more are likely to go within the next few months. Almost none of those discharged, with the exception of a few riveters—the most difficult class of ship workers to obtain—have been replaced. The present working force is 7,600 approximately.

A similar condition exists in the Vulcan-Werke, where a normal staff of 12,000 has been reduced to 8,000 within the past year. The real decrease in shipworkers here is even more than indicated, for approximately 2,500 men have been diverted to a new line, the manufacture of locomotives in the Vulcan plant. A year ago the Vulcan-Werke was working on two shifts. Today it is only working on one, and all overtime has been dispensed with. This factory has also had its own trouble with radicals, having declared a ten-day lockout when the workers attempted to nominate their own managers. Five hundred of the radicals and their leaders were discharged.

The conditions of these two yards in general, however, are still considered as a species of prosperity from the mere fact that they have not been worse. The Weser works of Bremen may not have received any new contracts lately, but they are busy at work on fourteen first class vessels which will keep the yards in a state of reasonable activity for the greater part of the next two years. One of these ships is the Ohio, a 19,000-ton steamer for the Royal Mail, destined for New York trade, which was started before the war as a Nord-Deutsche Lloyd vessel. Another is a yet unnamed steamer of approximately the same size for the Compagnie Mesagerie Maritime. Both are being completed under the reparations pact. Other vessels are building for the Nord-Deutsche Lloyd and the Hansa and Argo lines.

The Vulcan-Werke, really a much larger plant, is working on only seven ships, though their combined tonnage is greater. The Vulcan-Werke, which moved its principal plant from Stettin to Hamburg many years ago in order to have a share in the repairing of great ships which sought that port, soon found the harbor equally well adapted to the building of giant liners. Since then it has built such world famous ships as the Imperator and the George Washington. It is doing virtually no construct-

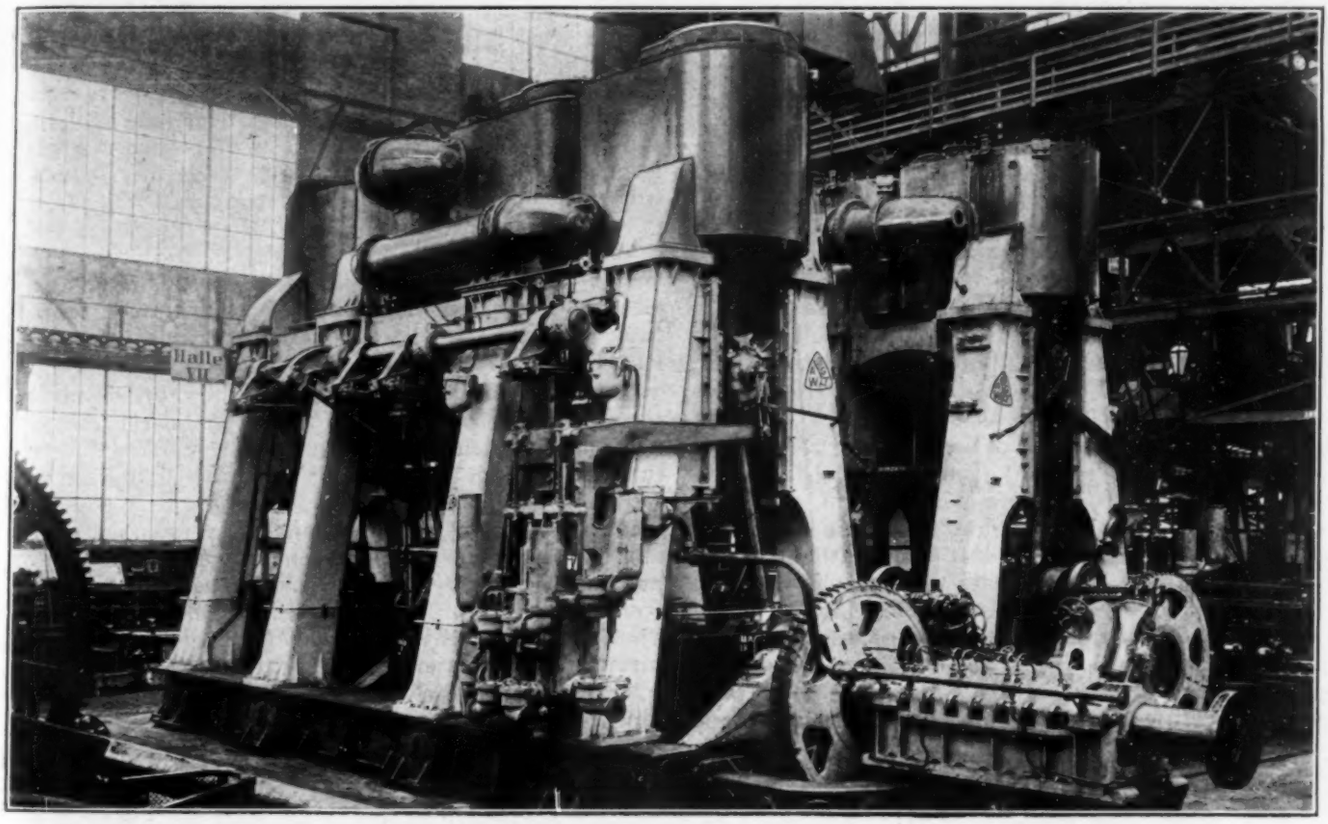


FIG. 4—THE ENGINE OF THE STEAMER BRABANTIA, CONSTRUCTED BY WESER

ing work for foreign shipping lines and has done little or none since the war, with the exception of converting a few English steamers into oil burners. The only expectation of receiving foreign orders in the near future rests on the extension of the reparations-in-kind program.

The comparative prosperity of German shipbuilding, then, is not due to any boom of the shipping market. It is owing principally to the fact that shipbuilders have shown great facility in adapting the industry to the changed conditions of the day. Like many of the French shipbuilding plants they have turned much of their energy to the manufacture of locomotives. In a previous article, we showed how the building and repair of locomotives had virtually saved the Chantiers de la Loire of Nantes from bankruptcy. Dutch shipyards have done the same to a lesser degree.

It might not be amiss here to repeat what was noted a few lines back, that the making and repairing of locomotives in the Vulcan-Werke gives employment to 2,500 men, or nearly a third of the total force, who build

or overhaul approximately 500 locomotives in the course of the year. The Weser works have also partially rebuilt one of their shops for this purpose, although the actual work of locomotive construction here is not nearly so far advanced as in the Vulcan plant.

Locomotive making is virtually a new experiment for companies like the Vulcan-Werke, and is one of the direct fruits of the revolution. On the day of the revolution—everything in Germany dates from then rather than from the war—German workmen everywhere laid down their tools and refused to continue the making of munitions and war machinery. The Vulcan-Werke, of course, had thrown every ounce of its energy into the building of submarines as the backbone of the German Admiralty plan. These were now under the ban. There were no other orders for ships, and an army of idle workers were on hand threatening trouble. Locomotives saved the day. Work was recommenced on the day following the revolution.

As may be seen, there has been an astonishing unanimity with which Continental shipyards have invariably turned to railway equipment to help them out of trouble. The answer is simple, however, and lies in the ease with which boiler plants can be used, almost indifferently, both in the making of ship machinery and locomotives.

"There," said Herr Stahl, "we have the advantage over English shipyards, where the boiler, the hull and the machine of a vessel are each built in a separate factory. Here, as well as in France and Holland, nearly all engineering work and boiler making are done in our own plants."

What Becomes of the Submarines

The Weser and Vulcan-Werke no longer build submarines; but a profitable sideline has been built up out of salvaging them. The Treaty of Versailles required the scrapping of the German submarine fleet, but nothing was said about scrapping the engines. These are just as valuable in a power plant as in a U-boat, and rather less destructive. The shipyards, with their obvious facilities for this work, have converted many submarine engines to stationery uses by diminishing their number of revolutions and decreasing the horsepower. Since the revolution the Weser works have completed fifteen such orders; the Vulcan-Werke twenty to twenty-five. The converted engines will be used chiefly in the south of Germany.

In other cases the German shipyards, in meeting the needs of the day, have been compelled to go backwards. The fall of the mark makes the price of oil for German vessels almost prohibitive unless they happen to be bunking fuel in Asia or America, where the world's oil supply is produced.

Oil Burners Not So Popular

The demand for oil burners, therefore, is only a fraction of what it might be under normal circumstances. The Diesel motor market in Germany is in a slump. Steam engines, especially the gear turbine type, are most in demand, for Germany, even though deprived of Silesia and Alsace-Lorraine, is a coal, not an oil producer. This is true especially of vessels sailing to the Mediterranean, which can obtain oil neither at home nor abroad. German ship builders are agreed that the oil burner is the vessel of the future. Not, however, of the present so long as Germany is compelled to buy oil at as great a disadvantage. For this reason Germany, which originally produced the Diesel motor, is in danger of being left behind in its future development.

Nowhere, though, have the altered conditions made themselves felt so much as in the system of contractual agreements which has come into being perforce. The future, being an unpredictable quantity in industrial Germany, has no existence economically. It is possible only to gamble, and machine manufacturers do not show any disposition for gambling on a lame horse. Any price quoted today is almost sure of being changed a score of times before the contract is completed. A paper profit made today is very apt to be wiped out by the next invoice for raw materials.

This condition was bad enough when even the German producers of raw materials refused to discuss values in

FIG. 5—REPAIRING LOCOMOTIVES GIVES WORK TO 2,500 MEN AT THE VULCAN-WERKE

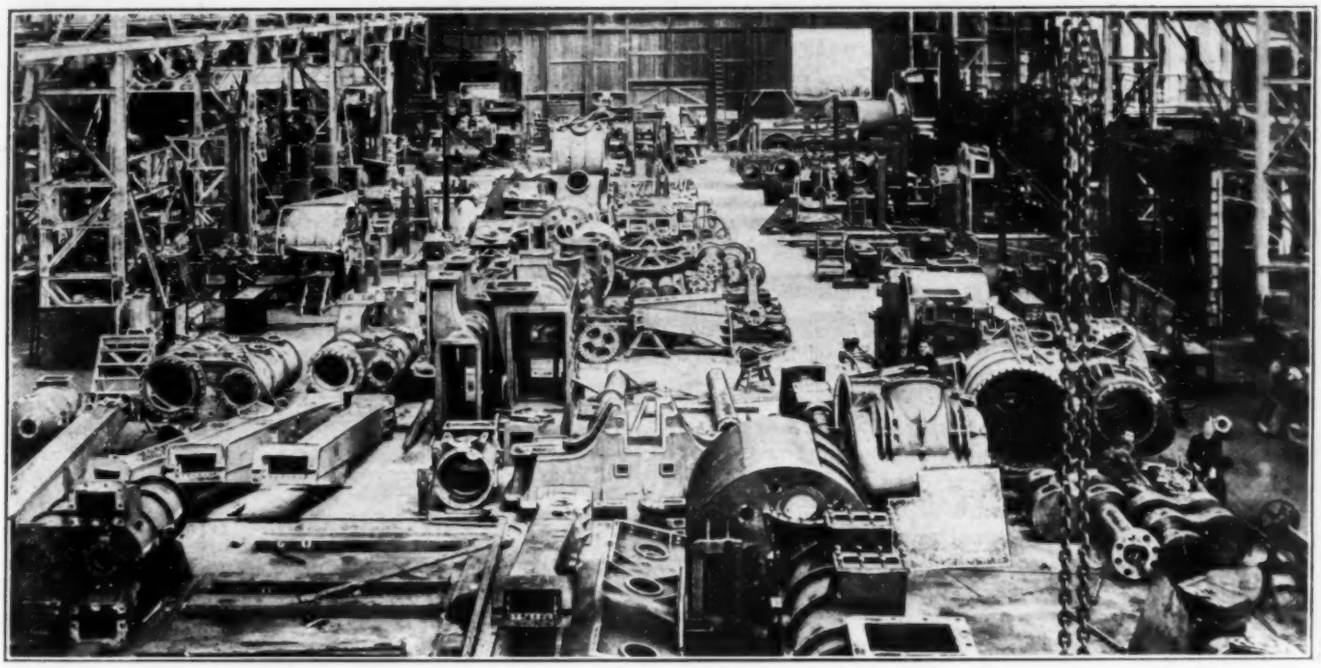


FIG. 6—INTERIOR OF THE WESER SHOPS. THESE PEOPLE ARE HOPING TO INDUCE THE ENTENTE TO ACCEPT 200,000 TONS OF SHIPPING AS REPARATION IN KIND UNDER THE TREATY

terms of marks and insisted on being paid in pounds or dollars, which had to be bought by the manufacturer on the money market. It has been further complicated by a new German law forbidding such purchases of foreign currency, an heroic effort to keep the mark from becoming entirely submerged as was the Austrian crown. Such a law, endeavoring to make the mark once more a basis of contractual agreements, is declared by machine manufacturers themselves to be incapable of enforcement. Even if enforced, they say, it will not remove the present uncertainty, which is at the bottom of the difficulty.

They Never Mention Price

It is here, however, that the German ship builder shows his resourcefulness. One does not speak of prices. They are the unmentionables of industry. The Weser company uses two forms of agreements—the sliding scale and the monthly statement. The first establishes a scale of costs for various classes of work. In this case the purchaser agrees to meet all increases when and how they occur. The second gives no estimates, but issues a statement at the end of each month with an itemized cost of labor and materials as averaged for the given period. The customer is invited to send his own engineer to check up possible discrepancies which might well occur in any similar case.

The Vulcan-Werke accepts more responsibility, but is even less disposed to discuss prices, even on a theoretical basis. Despite the unsettled conditions of the day, it will guarantee practically everything except cost. It will, for example, guarantee that the purchaser will not have to pay for more than a certain number of hours of labor for the job completed.

"Our failure in that respect," said Herr Stahl, "testifies to our lack of discipline, the breakdown of our organization. With that the customer has no influence."

The cost of labor within these limits, however, must be met as it increases. The same is true of materials. The company will agree that a certain piece of work will not require more than a specified number of tons. The price of the material, however, rises with the market—that is to say, with the fall of the marks.

Manufacturers have no other recourse than this, especially now when labor is skyrocketing. In September, the average shipbuilder's wage was 650 to 700 marks per day. In October, it rose to 1,000 marks. A further rise, of thirty to forty per cent, occurred the following month. By the time this is printed other increases will have taken place and another or several other readjustments will have been the result.

Materials rise more slowly, but just as surely. On Sept. 15, the Weser was paying 55,600 marks per ton for machine material. On Oct. 15 the price was in the neighborhood of 100,000 marks. Again, buying hematite, the company paid 29,700 marks per ton in September. In October the price rose to 38,000. According to Herr Stahl, virtually all finished material is obtainable in Germany itself today, although a year ago about ten per cent was imported from Belgium alone. But the local demand for pounds and dollars brings the price up to the world level, less only the cost of freightage.

Any Guarantee Difficult

Even time and materials are difficult to guarantee, however, despite the fact that the Vulcan-Werke has found it advantageous to do so. It is not so easy to obtain iron as it was a year or two ago, no matter what the source, and a new order would probably take longer to execute than one already contracted for. Moreover, the increasing difficulty of borrowing marks from German banks has restricted capital to such an extent that it has begun to have a similar effect on output. Anyone lending a thousand marks today may receive back only eight hundred or less in actual value tomorrow. Or, if actual value is demanded in return, the debtor has to liquidate to meet his obligations. Whichever way it turns, somebody is almost sure to lose. Consequently capitalization on a mark basis has lost most of its flavor.

The paper mark itself is often difficult to obtain, for labor, at any rate, must be paid for in cash, not credits. This stringency is due not to any poverty on the part

of the manufacturers, but rather to the incapacity of the German Government printing presses which, working day and night as they do, are unable to turn out enough currency to meet the demand.

Evils of "Company Money"

We have spoken previously of certain German machine manufacturers who attempted to solve the problem by printing their own currency by permission of the Government. In some cases the Government has even urged business men as well as municipalities to help along the national presses, and as a result Germany is flooded with varicolored commercial paper in all degrees of artistic horror and some excellence, but which is more eagerly taken up by album collectors than workmen.

With this uncontrolled inflation the Weser works and the Vulcan-Werke will have nothing to do, the former because its influence has thus far been strong enough to give it first lien on the output of the Government printing plants; the latter as a matter of principle. Herr Stahl, in fact, recently journeyed to Berlin himself to remonstrate with the Government against the practice. He said:

"Secret inflation solves no problems and merely sharpens those we already have. If factories are allowed to supplant or complement banks of issue, we shall soon see every man setting up his own printing press to meet his obligations. If we must have inflation, it is better to let the Government do it and accept the responsibility. The present policy lowers confidence, and, which is worse, workmen believe their employers need only to speed up their printing presses a little to increase their wages."

Machines That Are Human

Everybody is familiar with the dread picture of machinelike monotony that the enemies of machines portray—a man standing by a great mass of metal punching a hole in the same place in the same sort of product hour after hour, day after day. In contrast there have been at the Silk Show machines of an utterly different character—the modern loom weaving as by a miracle the most marvelous fabrics, swiftly, unerringly, obedient to the touch of an operator who seems to think with it and match its thousands of complex motions by a sympathetic understanding and skill.

It is the old-fashioned hand work that is usually set up as so much more desirable a labor. The dancing shuttles of a Jacquard loom suggest the dancing fingers of an old French peasant woman knitting lace. They move so swiftly that it is hard to follow them with the eye. The fabric grows as imperceptibly, as surely. Yet is not any comparison between such hand work and the handling of such a machine vastly in favor of the modern method?

There is a plenty of manual dexterity still required. The watch must be constant for broken threads, for empty shuttles, for a change of pattern. But the wooden fingers have replaced all the old nervous, petty motions of flesh and blood and bone that by the thousand and million go into lace making, for example. The hand loom of the last century represented a stage between. The modern loom is a consummation of automatism that seems incredible to the casual onlooker. In it all but the aid of a directing brain and, for moments from time to time, deft fingers has been dispensed with.

But surely here is no stultifying, cramping task for an operator. There is appeal to the imagination as the pattern grows and a finished product is prepared under one's eyes. The operator of such a machine is anything but a mechanical cog; his is rather a brain and skill in partnership with the brain and skill of the machine. Surely, when a machine reaches this stage of development, when it becomes itself almost human in its intricacy of co-ordination and power of action, it cannot be classed as a destroyer of human initiative and character. Rather does it seem an inspirer to growth and a stimulus to thought and action.

So there are machines and machines. Or, rather when a machine has all the skill and ingenuity and companionability of a marvelous fellow-worker it is not a machine. Which is at the least a side of the machine problem which deserves to be recognized along with its undoubted difficulties. [An editorial from the *New York Tribune*.]

Effect of Manganese on Steel

A method of preparing very pure iron has been developed at the Bureau of Standards and with this iron as a base various commercial steels and other iron alloys have been made for the purpose of testing them without the complicating effect of impurities which are usually present in commercial iron and steel.

The use of manganese as a strengthening agent in addition to the carbon is the subject with which the investigation was chiefly concerned. Manganese is also used as a deoxidizer and as a desulphurizer, but these uses are better understood.

The use of higher percentages of manganese for producing high tensile properties in low and medium carbon steels has been recommended at times by various metallurgists and to some extent such recommendations have been carried out in commercial practice. The results obtained in this investigation of the structural effects of manganese in steel strongly confirms such recommendations concerning this use of the element.

The general effect of manganese may be concisely described as a "restraining influence" so that the pearlite or carbon-bearing constituent of steel, even after annealing, exists in a very fine grained condition if considerable manganese is present. In this respect the steel resembles in structure the condition which usually obtains in similar steels of low manganese content after rather rapid cooling, for example, air-cooling. The mechanical properties of the annealed high manganese steel are quite similar to those obtained in the lower manganese steel by cooling it more quickly.

Ordinary carbon steel containing approximately 0.90 per cent carbon is termed by metallurgists, "eutectoid" steel, since it presents a uniform structure of pearlite. For many purposes such a steel is the best one to use. An additional effect of manganese upon steel is to shift the eutectoid composition to lower carbon contents by approximately 0.12 per cent for each per cent of manganese.

Manganese also appears to have a very noticeable effect upon the rate at which high carbon steels, such as carbon tool steels and file steels, assume the granular or "spheroidized" state—a condition which for many purposes is very desirable. Manganese exerts its characteristic retarding influence upon this change. This paper, "Preparation and Properties of Pure Iron Alloys: III. The Effect of Manganese on the Structure of Alloys of the Iron Carbon System" is Scientific Paper No. 464 of the Bureau of Standards.

Making Brushes for the Hoover Sweeper

By FRED H. COLVIN
Editor, *American Machinist*

Drilling operations, both hand and automatic—Special machine for trimming bristles—Testing driving belts—Inspection of various parts for straightness and accuracy

THE HOOVER sweeper has a motor-driven brush with an aluminum body in which the bosses for the bristles are cast in place. As the bristles are set in spiral rather than straight rows, the drilling problem is not susceptible to the usual treatment of either automatic or multiple drilling except by the building of special and somewhat complicated machines. The rows being spiral and the fact that the exact spacing is of little importance, have led to the drilling of the holes by hand in the simple fixture shown in Fig. 1. In addition to the holes for the bristles, a cross hole must be drilled for the binding wire which holds the bristles in place. Just to show that multiple drilling is not neglected where practical, a special machine for drilling 10 holes at once in the carpet-guard bar is illustrated in Fig. 2. The bars may be seen in the hopper *A*. The five spindles on each side are each driven by independent belts from the same driving pulley.

FIG. 1—DRILLING BRUSH BODIES FOR BRISTLES

Trimming the Brushes

It is, of course, impossible to get the tufts of bristles even, so they must be trimmed to length. This is done in the little machine shown in Fig. 3. The brush is placed in a frame or carrier and passed over a four-bladed lawn mower (mounted upside down below the table) which trims the bristles to the proper length, the brush being turned to bring the different tufts within reach of the revolving knives. The bristles are then sealed with a special quick-hardening glue. The uncut brushes are on the left and the trimmed brushes on the right.

Before the brushes are sent to the assembling department they are run from 1½ to 2 hr. on the testing stand shown in Fig. 4, to run the bearings in so there can be no stiffness when put to service. The stand holds 256 brushes, all run from a central lineshaft. The brushes are mounted in pairs and each belt runs eight brushes by weaving under and over the pulleys.

Inspection of Threads

Each brush carries a thread guard on the end, which is held to close limits and is subjected to 100 per cent inspection as shown in Fig. 5. The thread is tested by an ingenious little reversing mechanism mounted on the end of a small motor. The round driving belt comes down around the pulley at the right, back up over the swinging idler in front and down over the reverse pulley at the left. A sensitive friction inside the two pulleys enables the operator to run the spindle carrying the plug thread-gage in either direction by a slight pressure one way or the other—a time saving method.

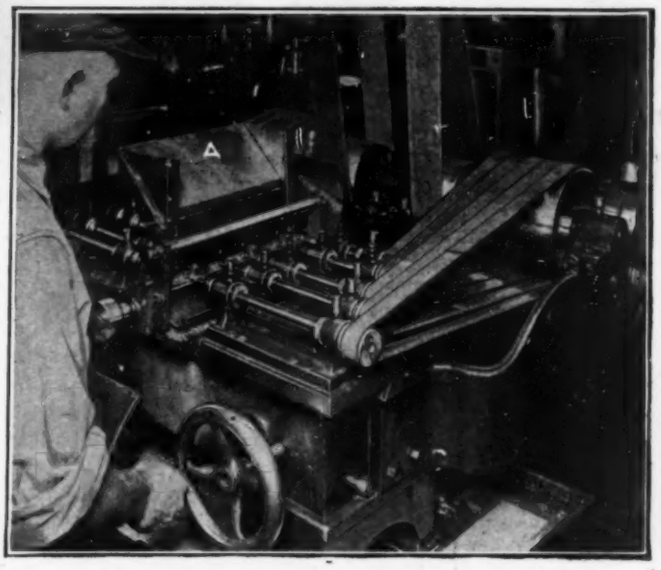


FIG 2—DRILLING CARPET GUARD

In order to secure best results the rubber belts used in driving the brushes should have the proper tension, and as this depends upon the quality of the belt itself, each belt is carefully tested on the machine shown in Fig. 6. Tension is supplied by the spring *A* and the

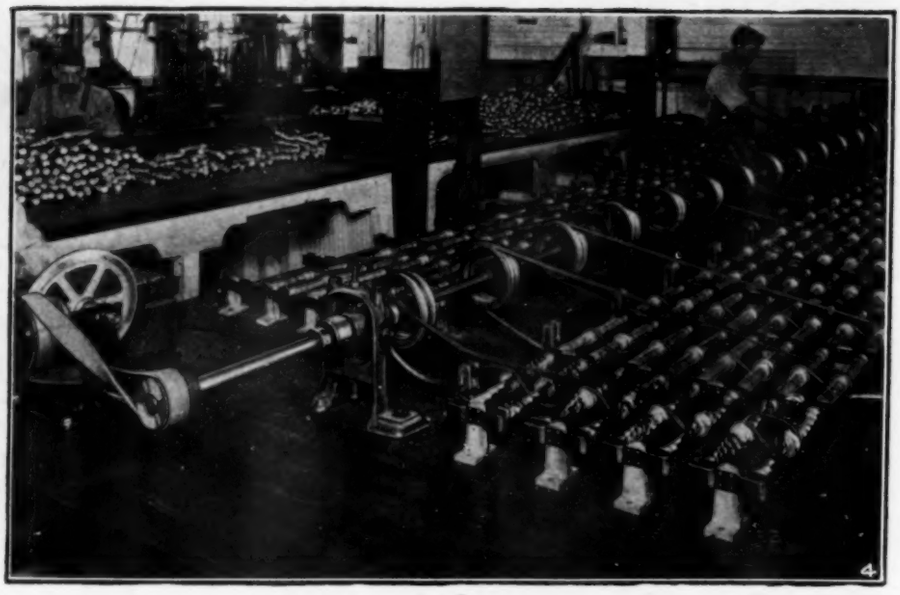


FIG. 3—TRIMMING THE BRISTLES. FIG. 4—RUNNING IN THE BEARINGS

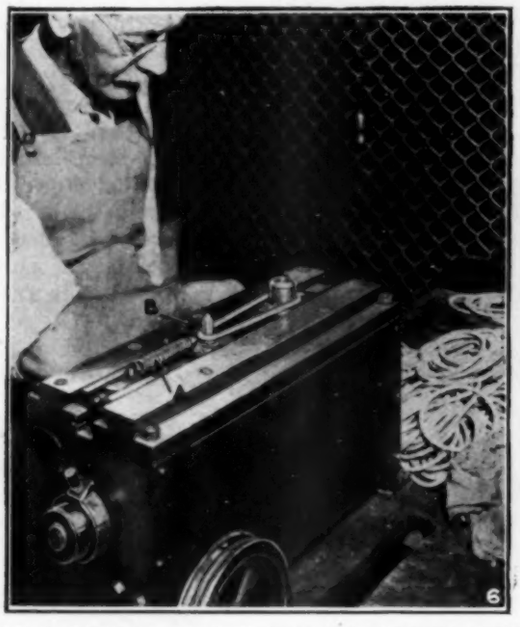


FIG. 5—INSPECTING THREAD GUARDS. FIG. 6—TESTING DRIVING BELTS. FIG. 7—INSPECTING CONCENTRICITY OF BRUSHES

stretch of the belt is shown by a pointer at *B*. Two limit marks are provided and when any belt allows the pointer to get beyond either of these marks, it is promptly rejected. The larger spindle at the right is revolved so as to give the belt the same test which it would receive in practice. Motion is provided through the pulley shown at the right.

The complete brush is inspected for concentricity and end play, as in Fig. 7. The driving pulley in the center must run true within 0.010 in. as indicated by the dial gage at the back. Slight errors are corrected with the mallet shown.

The shafts on which the brushes run are inspected as shown in Fig. 8. The girl on the right is testing for length between shoulders with a "go" and "no go" gage conveniently located, while the one at the left tests them for straightness by rolling them on a flat plate with a white background which will show light if the shafts are bent.

FIG. 8—INSPECTING BRUSH ROLL SHAFTS

Machining Half Bearings For Airplane Motors

By WALTER LAWSON ADAMS

A method devised during the world war for making airplane motor bearings with unskilled operators — The fixtures used

THE GREAT demand for bearings for airplane motors during the world war and the scarcity of operators with even ordinary machine-shop experience, made it necessary to devise a method by which unskilled or semi-skilled men and women could secure the desired accuracy, as well as produce the quantity required. The main object in view was to produce half bearings with such accuracy that any two halves could be assembled into a complete bearing without fitting.

The first operation was to clamp the half bearing in a vise on a shaper and face the two sides. The sides were then rubbed down on a lapping plate made in the usual way with cross grooves. Sea sand and water were used as the abrasive, and it only required a few rubs to make the surfaces flat.

Then, the mandrel shown in Fig. 1 came into play for the roughing and finishing of the bearings. This mandrel was made of low-carbon steel, casehardened and ground, so that the central portion at *A* exactly represented a finished half bearing. The flanges and central portion were glass hard and ground to 0.001 in. less than the desired size of the finished bearing, as a minimum. These hardened surfaces acted as a stop or sizer for turning both the diameter and the thickness of the bearing flanges, as the tools could not cut below the hardened surfaces. Fig. 2 shows an end view of a half bearing clamped on the mandrel.

After turning the flanges, the half bearing was gaged, as shown in Fig. 3. It had to just push through this gage, and if it did not, a slight touch on the lapping plate corrected any defects.

Any two halves were then placed together and pushed into the chuck shown in Fig. 4, which screwed onto the lathe spindle. This chuck is split and has a sleeve on the outside carrying four headless setscrews by which the chuck is tightened, so as to hold the two halves firmly in place. The half bearings were then rough bored, and the radius turned on the outer ends. They were next reversed, so as to turn the radius on the opposite ends, and were ready for babbitting, which was done in the usual manner. They were then tested for the firmness of bond between the babbitt and shell, and very few rejections were necessary.

Any two halves were then held in the mandrel shown in Fig. 5, and clamped by the flanges. The long bearing sleeve *A*, fitted over the central portion of the mandrel and was adjusted by the nut *B*. Both flanges of the mandrel were hardened and ground, so as to serve as

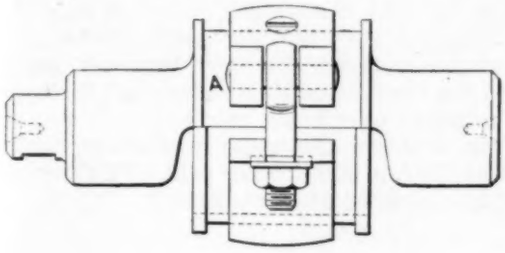


FIG. 1

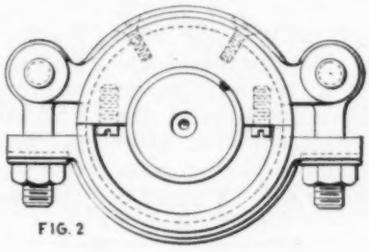


FIG. 2

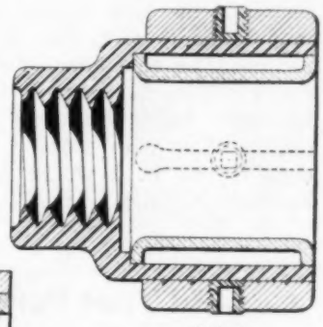


FIG. 4

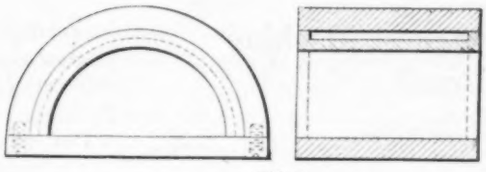
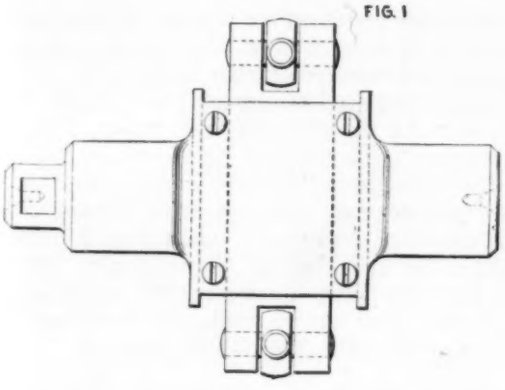


FIG. 3



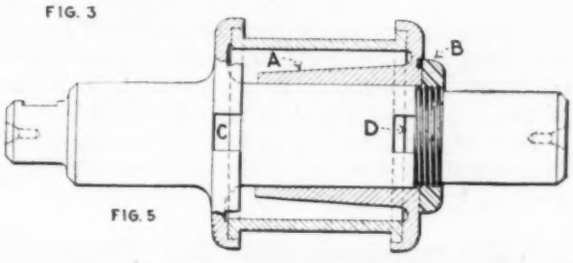


FIG. 5

FIG. 1—MANDREL FOR TURNING BEARINGS. FIG. 2—END VIEW OF MANDREL. FIG. 3—GAGE FOR SIZING BEARING FLANGE. FIG. 4—SPRING CHUCK FOR BORING BEARINGS. FIG. 5—MANDREL FOR FINISHED GRINDING

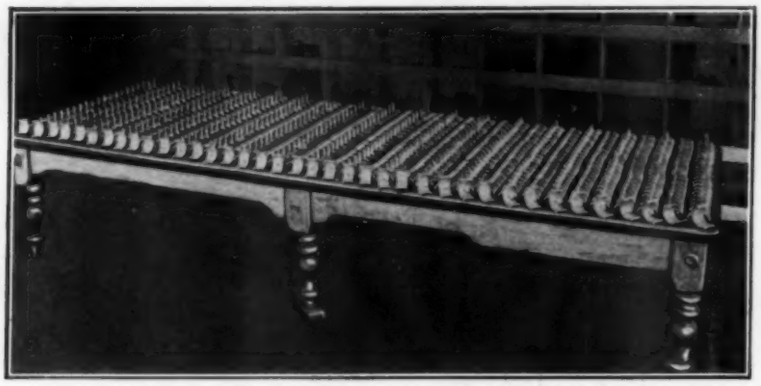


FIG. 6—A WEEK'S OUTPUT OF BEARINGS

stops or gages for the turning tools. The flanges were also cut away at one point, as shown at *C* and *D*, so as to allow gaging and to show by visual inspection whether the flange faces were firmly seated.

With the half bearings clamped in this same mandrel, the work was sent to the grinding machine, and the outside diameter ground to size.

The final operation was to put any two halves in a chuck of the type shown in Fig. 4, where the babbitt was bored to size, the oil grooves cut and the ends radiused to suit the crankshaft. The mandrels and chuck shown herewith were used for several sizes of bearings, using bushings for distance pieces in the chuck. The plan worked so satisfactorily that after once trying it, I would never again bother to make bearings in pairs. The fixtures could easily be used for bearings to be used with shims, by providing dummy shims for such operations as found necessary.

As an interesting sidelight on the accuracy and adaptability of this method, I may state that the maximum limit allowed was 0.001 in., which was secured entirely without skilled labor. When the job was put up to me, I took over a steam laundry with its women workers, and secured the tool equipment from local garages, as I knew it was impossible to get machinery without a long delay from the tool department of the War Ministry.

I was able to procure half a dozen lathes from 10 in. swing up, a No. 2 Brown & Sharpe universal grinding machine and a tool-room shaper. While these machines were being overhauled and put in first-class shape and the laundry machinery moved out, I designed and made the mandrels and chuck shown herewith, together with what gages were necessary.

After two weeks, with three men, each in charge of a gang of nine girls working on 7-hr. shifts, we were turning out 800 half bearings per day. These bearings were for tank motors and were 3x4 in. The rejections were less than five per cent. Three men kept the machines running, sharpened the tools, gaged and inspected the work. The shops which had formerly made these bearings were being paid at the rate of $9 per pair. Fig. 6 shows one week's production, which was secured at the rate of $1.50 per pair. This method can be used in a number of other places.

Old Time Portuguese Machine in Brazil

By J. D. Mooney
Vice-President and General Manager, General Motors Export Corp.

Along the road in the interior of Brazil I came upon the simplest and crudest mechanical device I have ever seen and I thought it might be of interest to some of the readers of the *American Machinist*.

They say in Brazil it is an old Portugese invention. It is called a "Manjola," although I am not sure of the spelling, and it is used for grinding grains. As will be seen, it is a crude water-power device. A section of timber about 12 x 12 in. and about 12 ft. long is cupped out on one end and mounted on an upright, trunnion fashion. The cup is placed under the sluice where the water runs out. As the cup fills with water, Fig. 1, the weight depresses the cup end as shown in Fig. 2. The water discharges and the other end of the beam, which is now the heavier, descends with a bang and drives the pestle into the mortar, as in Fig. 3. This completes the cycle and the cup again begins filling with water. The apparatus is not a modern machine in any sense of the word, but it works, nevertheless, to the satisfaction of the natives who have to use it.

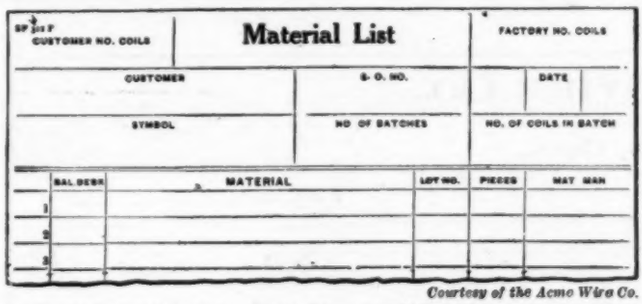
FIG. 1—FILLING THE CUPPED END WITH WATER. FIG. 2—BEAM RAISED BY WEIGHT OF WATER. FIG. 3—CRUSHING GRAIN IN "DOWN" POSITION

Industrial Cost Accounting for Executives

By PAUL M. ATKINS

The eighth article—Material records and control—Determining maximum and minimum quantities—Operating the balance card—Purchasing, receiving and issuing material

THE PROBLEM OF the control of material is divided into two parts according to whether the material is constantly carried in stock or whether it is necessary to order specially for each manufacturing order that is written. For both these methods, however, it is necessary to maintain a perpetual inventory. In the first case it is customary to operate on what is known as the "maximum-minimum quantity" basis. The idea underlying this method is quite simple. When the quantity of material on hand falls to a certain determined minimum point enough more will be ordered to bring the quantity up to a certain other figure, the maximum. A slight variation is to order a definite quantity of material when the minimum point is reached. The minimum must be determined in such a fashion that the company will never be without material, and the maximum, or the quantity to order, must be calculated in such a way that the concern will not have too much capital tied up in its inventory at any given time.



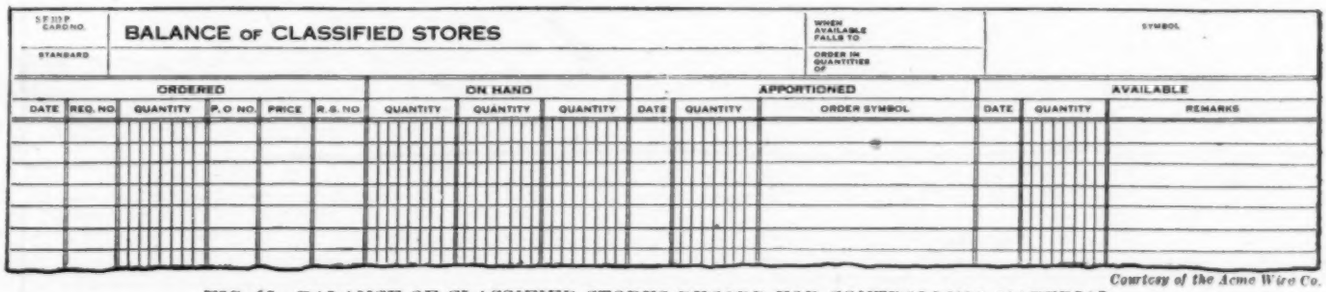
Courtesy of the Acme Wire Co.

FIG. 14—MATERIAL LIST FOR ORDERING MATERIALS

The minimum figure is usually the more important of the two for it is more costly to the company to run out of material than it is to be slightly overstocked. On the one hand if the minimum is so set as to be sure that there is enough material available, there is almost always a tendency to overstock. On the other hand, if the effort is made to set the figure so as to keep the inventory as low as possible, there are times when shipments will be delayed or work on material in the factory held up, and hence schedules upset or production delayed.

A "re-order" point should be fixed which corresponds to the common acceptance of the minimum quantity and when the amount of material on hand falls to that figure, an order for more should be placed in the regular routine fashion. Below this re-order point should be set the real minimum figure which is essentially a danger point. When the quantity of material falls to that figure it is time to use telephone and telegraph, express and motor truck, or overtime in the factory until the material is safely landed in the storeroom.

The maximum figure or the quantity to re-order will depend on a very careful balancing of the relative economy of large scale production or purchasing against the costs of carrying large inventories. This figure cannot be decided upon without reference to the cost records in order to obtain the comparative costs, and often, also in setting the re-order and minimum points, information from the cost department proves valuable.



Courtesy of the Acme Wire Co.

FIG. 15—BALANCE OF CLASSIFIED STORES RECORD FOR CONTROLLING MATERIAL

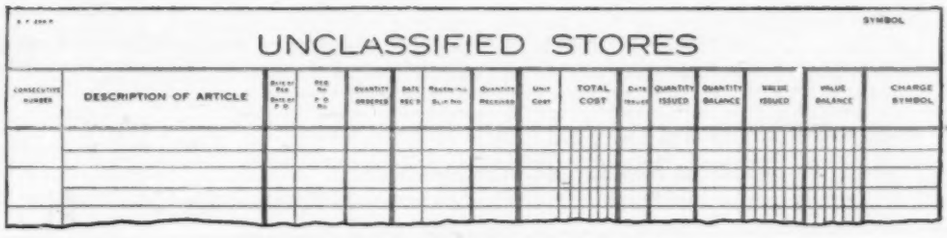


FIG. 16—UNCLASSIFIED STORES RECORD

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S.F.13P

REQUISITION A № 952

REQUESTED BY DEPT. NO._____ MONTH_____ DAY_____ 19

THAT THE FOLLOWING ITEMS BE PURCHASED FOR

IMP. OR REP. NO	DEPARTMENTAL USE	EXPERIMENTAL	MACHINE	ORDERS	COST CODE	CUSTOMERS	PERSONAL ORDERS
				S.O.		P.O.	

SYMBOL	QUANTITY	DESCRIPTION	AMOUNT IN STORES

SHIP VIA	CHARGES	TERMS	F. O. B. POINT	MINIMUM	MAXIMUM	MUST BE IN STORES

STOREKEEPER ENDORSEMENT	REQUISITIONER'S SIGNATURE	APPROVED BY

PURCHASE OF

PURCHASE ORDER NO._____ WRITTEN MONTH_____ DAY_____ 19 BY

A № 952

THIS PERFORATED SLIP MUST BE RETURNED TO BALANCE OF STORES DESK AND POSTED ON DUPLICATE COPY OF THIS REQUISITION. REQ.

REQUISITION RECEIVED	WILL BE PURCHASED AS REQUISITIONED	REQUISITION CANCELLED
MONTH DAY 19	WILL NOT BE PURCHASED AS REQUISITIONED	NOTE DIFFERENCE ON P.O.

Courtesy of the Acme Wire Co.

FIG. 17—REQUISITION FOR ORDERING MATERIAL

The question of material which must be procured for only one manufacturing order is quite a different problem, and yet in many jobbing types of industry this kind of problem is the rule and not the exception. The most obvious, but seldom the most satisfactory way of dealing with the matter is to take a bill of material for the order and order from that. Most of the materials may be special for the order, but often there are standard parts like nuts and screws, or standard materials like steel rod or sheets, or glue, which are carried constantly in stock on the maximum-minimum basis.

If more than one unit of a particular kind is required by the order, the number of units must be multiplied by the number of parts per unit to find the quantity of parts needed. The solution of this problem is to prepare a material list, such as is illustrated in Fig. 14, on which may be recorded just the kinds of materials required for this order and the quantity of each type of material.

Obviously, there are many different classes of materials and the mode of classification will depend upon the end sought. The materials might be divided into

S. F. 13 P

THE ACME WIRE CO.,

NEW HAVEN, CONN.

DATE_____

№ 852 B

TO_____

KINDLY ENTER THE FOLLOWING ORDER

PUT THIS ORDER NUMBER ON YOUR INVOICE

SHIP VIA	TRANSPORTATION CHARGES	TERMS	F. O. B. POINT	REQUISITION No.	IMP. OR REP. NO.

QUANTITY	DESCRIPTION OF MATERIAL WANTED

GOODS MUST BE SHIPPED TO REACH NEW HAVEN NOT LATER THAN MONTH DAY 191

ORDER SUBJECT TO CONDITIONS PRINTED ON OTHER SIDE

ACCEPTANCE OF THIS ORDER CONSTITUTES ACCEPTANCE OF ALL ITS TERMS

THE ACME WIRE CO.

PLEASE NOTE INSTRUCTIONS CAREFULLY

PER_____

PURCHASING AGENT

THE ACME WIRE CO., NEW HAVEN, CONN.

PLEASE RETURN THIS BLANK TO US

_____ 19

WE BEG TO ACKNOWLEDGE RECEIPT OF YOUR ORDER, AND SHIPMENT OF SAME WILL BE MADE

STATE DEFINITELY ON WHAT DATE YOU WILL SHIP.

"AT ONCE" OR "AS SOON AS POSSIBLE" IS NOT SATISFACTORY.

NAME_____

YOUR ORDER № 852 B OUR ORDER NO._____

Courtesy of the Acme Wire Co.

FIG. 18—PURCHASE ORDER SENT TO THE VENDOR

S.F.BP.

THE ACME WIRE CO.,

NEW HAVEN, CONN.

DATE_____

NOTICE TO FILE CLERK
Yellow and Pink copy must be pasted together at top, only, face up. Yellow on top.

SHIPMENT PROMISED

1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	Day

MONTH

1	2	3	4	5	6
7	8	9	10	11	12

CARDS SENT

1ST	2ND	3RD	4TH

SYMBOL

No 852 B

To_____

KINDLY ENTER THE FOLLOWING ORDER

PUT THIS ORDER NUMBER ON YOUR INVOICE

SHIP VIA	TRANSPORTATION CHARGES	TERMS	F. O. B. POINT	REQUISITION NO.	IMP. OR EXP. NO.

QUANTITY	DESCRIPTION OF MATERIAL WANTED

Delivery promised is satisfactory

Signed_____

GOODS MUST BE SHIPPED TO REACH NEW HAVEN NOT LATER THAN MONTH DAY 191

DATE	ITEM	QUANTITY	DATE	ITEM	QUANTITY	DATE	ITEM	QUANTITY	DATE	ITEM	QUANTITY	DATE	ITEM	QUANTITY

Courtesy of the Acme Wire Co.

FIG. 19—PURCHASING DEPARTMENT'S COPY OF PURCHASE ORDER

raw materials and purchased parts, or into supplies and direct materials, and from some points of view such classifications are helpful. In most cases, the division should be made according to whether the materials are purchased outside the factory or are produced within

OFFICE RECORD ORIGINAL

THE MEASUREGRAPH COMPANY
RECEIVING REPORT
No 7652

Purchasing Order No._____

DATE RECEIVED_____

DESCRIPTION	WEIGHT OR QUANTITY

RECEIVED BY_____

O.K._____ STOREKEEPER

Form 118. SE 510

Courtesy of the Measuregraph Co.

FIG. 20—RECEIVING SLIP

it. The first of the classes is commonly called stores material or simply stores and the second group worked material because work has been done to it to change its form or condition from that in which it was when it was brought to the factory. A third class might be added, the finished salable goods which are often called merchandise.

In the planning department the methods of controlling the supply of the two kinds of material are quite different. To obtain stores it is necessary to request the purchasing department to buy them, and then follows a whole series of contracts with outside concerns. To get worked material, on the other hand, a manufacturing order must be written and from that time on the regular routine must be followed for the control of production which may result in turn in the placing of orders for worked material or of additional stores.

The cost of these two kinds of material must be obtained from entirely separate and independent sources. For stores the cost is obtained from the invoices for the shipments plus the cost of transportation in, in some cases. For worked materials, however, the cost must be ascertained in the cost department from the records which are kept for the worked material orders. Hence, from both the production and cost points of view this classification of material is helpful.

A perpetual inventory of materials is absolutely essential to either production control or accurate cost records. In its simplest form, such a perpetual inventory is only a record of receipts and issue of material with the balance remaining on hand, and provides information as to the quantity on hand and also a means for pricing the withdrawals.

Modern practice, however, has developed a much more complicated form which is a real material control mechanism, and which provides the needed data on which to place orders and to anticipate future requirements. Such a form is illustrated in Fig. 15, although the particular shape which it will take will vary exten-

NO. OF SHEETS	ORDERED BY	DATE WRITTEN	GROUP ISSUE						ORDER OR ACCOUNT CHARGEABLE	
SHEET NO.	DELIVER TO DEPT.	RECEIVED BY	ISSUED BY		DATE ISSUED		ASSEMBLY NO.		BATCH NO.	
PART NO.	DESCRIPTION		AMOUNT WANTED	AMOUNT ISSUED	POSTED	UNIT VALUE	STORES		WORKED MATERIAL	
(Apr. 31 Art.)	TOTAL VALUES									

Courtesy of the Square D Co.

FIG. 21—MATERIAL ISSUE FOR SEVERAL KINDS OF MATERIAL ON ONE ORDER

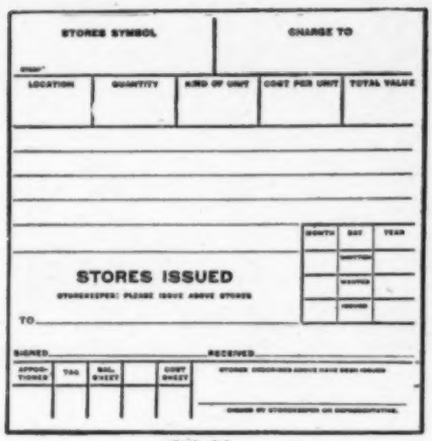


FIG. 22

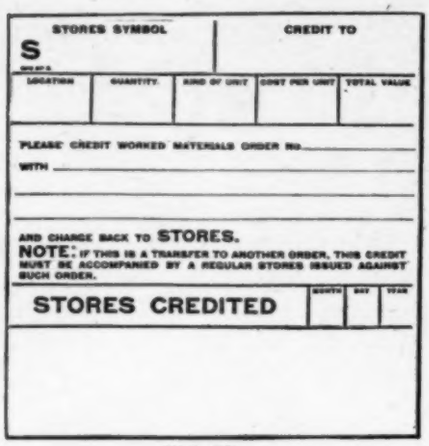


FIG. 23

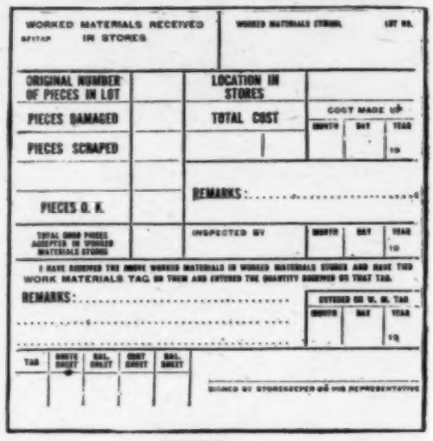


FIG. 24

FIG. 22—STORES ISSUE SLIP FOR ONE KIND OF MATERIAL. FIG. 23—STORES CREDITED SLIP
FIG. 24—WORKED MATERIAL RECEIVED IN STORES SLIP

sively according to circumstances. In practically all cases, however, there will be four main divisions: (1) material ordered; (2) material on hand; (3) material apportioned or assigned; and (4) material available or short. One of these cards will be made out for each kind of material.

The simple type of perpetual inventory is represented by the "on hand" section of the new form, and the other sections represent additional information. Frequently, a manufacturing order is written which, for some reason, is not to be worked upon until some future time. It is desirable, however, to see that material is provided for it, and this reservation of material is made by adding the quantity required for the order in the "apportioned" section of the card. The quantity of material on hand may not be sufficient, but it is quite possible that large orders have been placed for this material which will provide for this latest requirement. Hence it is necessary to know how much material is on order and this information can be obtained from the "ordered" section. A close check should be maintained on the accuracy of the entries on this form and so it is made self-balancing by the addition of an "available or shortage" section. From this we find the name "balance card" often given to this record.

Operation of the Balance Card

We may briefly summarize the operations performed upon this card as follows: When material is reserved, add in the "apportioned" and subtract in the "available" section. When material is ordered, add in both the "ordered" and the "available" sections. When material is received, subtract in the "ordered" and add in the "on hand" sections. When material is issued, subtract in the "on hand" if it has been reserved in the "apportioned" and if it has not been reserved in the "available" sections.

A record will be kept on a form of this sort for all materials whose receipt in the storeroom or whose issue therefrom takes place in small lots as compared with the total quantity handled. Frequently, some materials are purchased in small quantities at long intervals and to set up a separate card for each one would be a serious waste. For such items a form similar to that shown in Fig. 16 is desirable.

When stores are needed the most satisfactory manner in which to transmit the order to the purchasing department is by means of a purchase requisiton, illustrated in Fig. 17. When stores are ordered because the re-order point has been reached or because they are needed to meet the requirements of a manufacturing order, the balance clerk can write the requisition which can go to the purchasing department without any further delay. The conditions described above, are sufficient authority and the requisitions usually do not need to be approved. The stores called for should be amply specified, for errors which result from lack of information of this kind are likely to prove costly.

The Purchase of Material

In the purchasing department any additional information which may be needed to complete the purchase order should be placed on the purchase requisition so that the purchase order can be copied directly therefrom. The purchase order when accepted by the vendor is a legal contract and hence no ambiguity should be permitted in its wording. The company sending it out should insist on its prompt acknowledgment and the definite setting of dates of delivery. It is quite impossible to control production if material is not received in time. Several copies of the order should be made, one or more of which should remain in the purchasing department to be used in following up the order, and another sent to the receiving department. On these copies should be recorded any correspondence which takes place in respect to the order, shipments received and any other information which may be of assistance in controlling the order. In Figs. 18 and 19, very good illustrations of such forms are illustrated.

When material reaches the factory, a receiving slip shown in Fig. 20, should be made out for it. One copy should be sent at once to the purchasing department to notify it of the arrival of the goods. Often a second copy is sent as soon as the goods are inspected to be used in passing the invoice for them. Another copy should accompany the goods to the storeroom and then to the balance clerk, while a final copy is often left in the receiving department for reference.

With the materials safely in the storeroom, we face the problem of how to get them out again. It may be laid down as a rule which will admit of no exceptions that no materials—whether stores or worked material—should ever be allowed to pass out of the storeroom without a written order. In the case of a continuous process industry, this order may be written in the form of the standing order. Under such conditions a record must be made by the storekeeper of all material withdrawn during the day and this report must be turned in each

day for it will be needed by both the balance desk and the cost department.

More often, however, it will be desirable to write a separate order each time material is wanted. The common name for this order is material requisition or material issue. These issues form an integral part of the control of production and all costs of material are obtained from them. They take several different shapes to meet various needs. If several kinds of material are wanted at once for a single order, then a group issue, as shown in Fig. 21, is very useful for all the material can be called for on one issue. Material for more than one order should never be called for on one issue. There are two columns in this illustration for the extensions, one for stores and the other for worked material to help in keeping the cost records separate.

If only one kind of material is wanted at a time, an issue like that shown in Fig. 22 is commonly used. There should also be the same kind of issue for worked material printed in a different colored ink or on different tinted paper to facilitate sorting. These issues are employed in the control of production for they are sent out by the dispatch clerk to the storeroom when he wishes the material sent to the shop, and their return to him indicates that this has been accomplished.

In case more material than can be used is sent out to the shop for a certain order it is necessary to return the material to the storeroom, and to record this transaction a credit slip shown in Fig. 23 is employed. Like the single issues there are usually two kinds of them—one for stores and one for worked material. Like the issues, they are entered on the balance cards, are then sent to the cost department where they are used in figuring the inventory and the cost of the orders.

When worked material is completed and turned into the storeroom, another form is used, ordinarily called a "worked material in" slip or a "worked material received in stores" slip, as shown in Fig. 24. This slip enters into both the production control and cost records for it is a sign in both departments that the order, or a certain portion of it has been completed. In the cost department it is also useful in maintaining a balance of the inventory.

Foundry Uniform Trade Customs

At the annual meeting of the New England Foundrymen's Association held January 10, 1923, the following uniform trade customs were adopted. The Secretary of the Association is F. F. Stockwell, 205 Broadway, Cambridge, Mass.

Patterns to be in condition to make castings of the quality and quantity required.

Correctness of patterns and core boxes to blueprints rests with customer.

If patterns require stopping-off or skeleton patterns are furnished, an extra charge will be made.

Any expense due to incorrectness of patterns and core boxes shall be borne by customer.

Repairs and changes in patterns by customer's order at expense of customer.

Patterns to be painted in three colors showing core-RED, machine surface-YELLOW and rough casting-BLACK.

All patterns, core boxes and loose pieces thereof should be properly numbered for identification.

All freight, drayage, boxing and crating to and from foundry on patterns, at expense of customer.

Foundry not responsible for loss of or damage to patterns by fire and theft.

Patterns not in use for a period of six months may be subject to storage charges.

Defective castings to be replaced by foundry free of charge if reported within a reasonable time.

Foundry not responsible for any expense incurred by customer on defective castings.

Claims for error in weight or number to be made within five days after receipt of castings.

Boxing, crating or bundling of castings not specified in contract are at the expense of customer.

All castings are sold as rough castings f.o.b. foundry unless otherwise stated.

In case customer requires special production service to secure quick delivery an extra charge shall be made.

Customer to be charged with cost of cores and molds discarded due to change in patterns or core boxes.

All changes in orders of any description must be made in writing.

Foundry shall not be liable in damages for failure to deliver, caused by strikes, differences with employees, accidents at foundry, or other causes beyond their control.

Unless otherwise agreed, quotations are for acceptance within 30 days.

Cancellations of orders are to be by mutual consent only.

Selling Machine Tools—Discussion

By John Thomas

Under the above title on page 854, Vol. 57, of the *American Machinist*, Entropy touches on some of the phases of machine tool selling which, to the writer, have always been more or less a mystery.

On the subject of publishing prices, just what would be the harm of doing so?

In looking up some of the more successful corporations and individuals in other lines of business it seems as though not a single one of them gives a solitary hoot who knows their prices. In fact they spend large sums of money in order that everyone may know what they are and seem to make every effort to keep the prices of the articles before one all the time. Surely these people are not doing this in order to help along the advertising firms and the publishers; it must pay them to do it.

To the writer, an advertisement that does not mention the price of the article advertised tells only half the story and the advertisement is not complete. Probably there are others beside myself who have looked through the advertising pages of the *American Machinist*, thinking of some particular tool which they were not quite ready to buy and yet wondering what the price might be. If the prospective buyer had some inkling of the price and so could make a sort of comparison beforehand, the choice could at best be narrowed down to two or three makers and it would not be necessary to correspond with a number of firms and more than likely bring a salesman from each.

No really square buyer cares to have half a dozen salesmen visiting him and piling up expense which must be added to the price of the tools they sell and which he knows he will have to help pay eventually. Waste is just as inexcusable in selling as in manufacturing.

Nearly all tool builders insist that their machines are sold at standard prices. If this is true then why not publish the prices and help lower selling costs.

It certainly must be much cheaper to inform the possible buyer what the price is through an advertisement than to send a special messenger in the shape of a salesman to do it.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

Machining a Differential Carrier

BY ROBERT BRAINERD

The carrier for differential gears in motor vehicles involves several machining problems. The illustrations show the method used in making the carrier for the Nash rear axle. This work is largely done on a 3A Warner & Swasey turret lathe, one of the reaming operations being shown in Fig. 1. The carrier is mounted on an angle fixture, as shown at *A*, which holds the end forming the bearing case, so that it can be reamed and tapped at each end, as shown in detail in Fig. 2.

After the front end has been reamed a reamer is inserted through the central opening in the carrier and

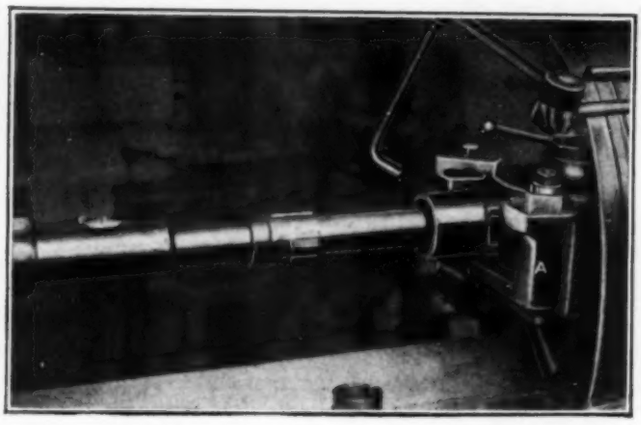


FIG. 1—REAMING THE END OF DIFFERENTIAL CARRIER

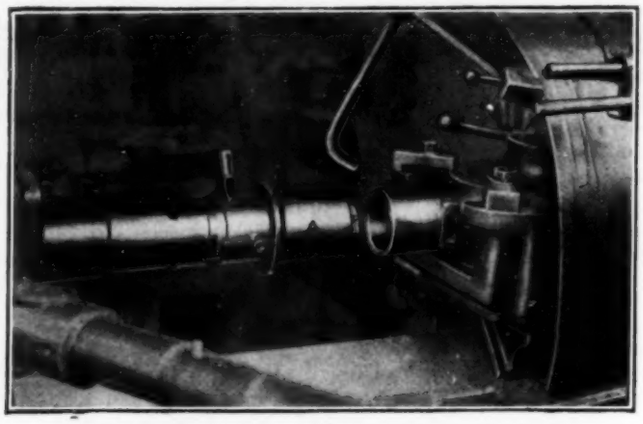


FIG. 3—CONTROLLING THE COLLAPSIBLE TAP

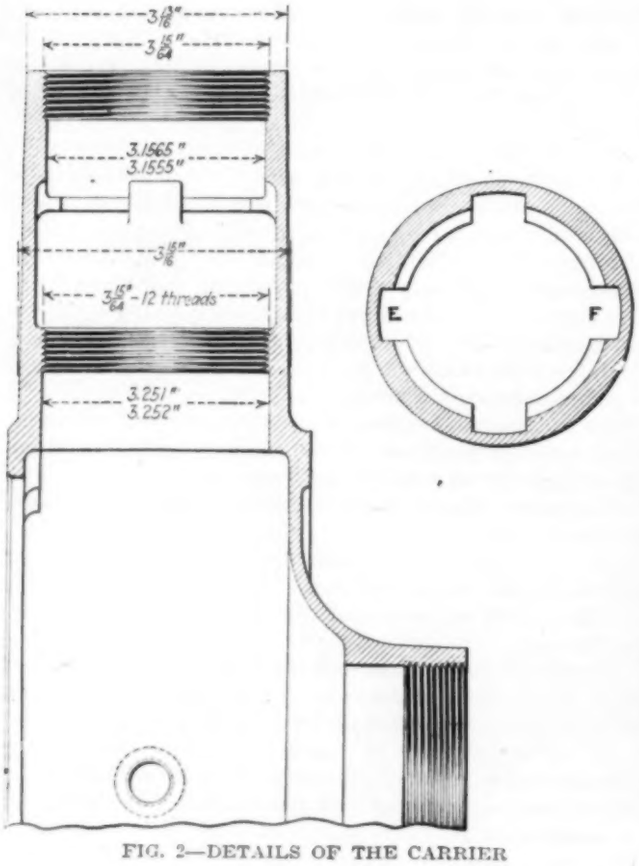


FIG. 2—DETAILS OF THE CARRIER

locked on the bar by means of a bayonet lock. The rear end of the hole is then reamed by pulling the turret toward the back end of the machine.

A collar *A*, Fig. 3, is next placed over a Murchey collapsible tap and the turret moved forward. This collar releases the blades when the tap has been fed into the hole the correct distance. After the front end has been tapped, the collar is removed, as in Fig. 4, and the tap inserted in the casting, the four blades passing through the four openings in the collar, as shown at *EF*, Fig. 2. The tap is then set and operated in the usual manner.

The boring operation removes on an average of 0.25 in. of metal, and the speed is 58 ft. per minute for both boring and reaming. Production is 7 pieces per hour.

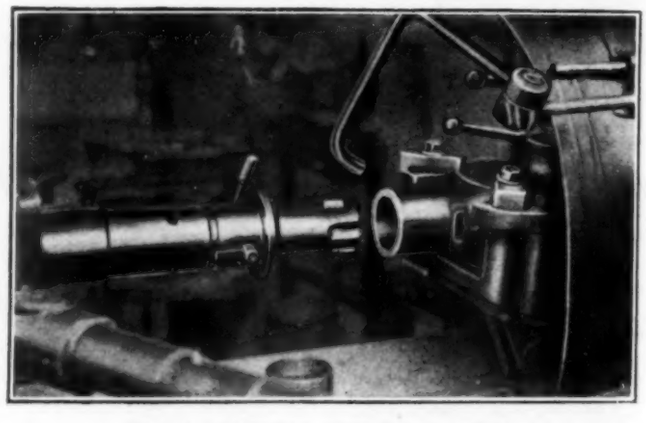
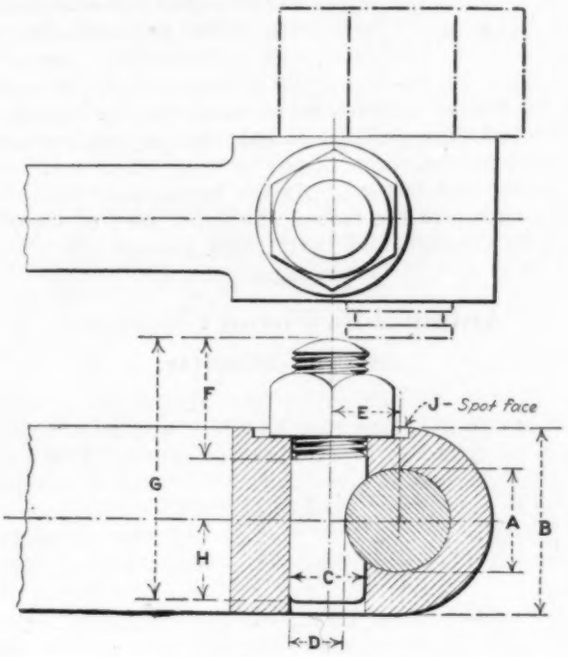


FIG. 4—TAPPING THE INNER END

Illustrated Tables of Clamp Collars and Clamp Studs

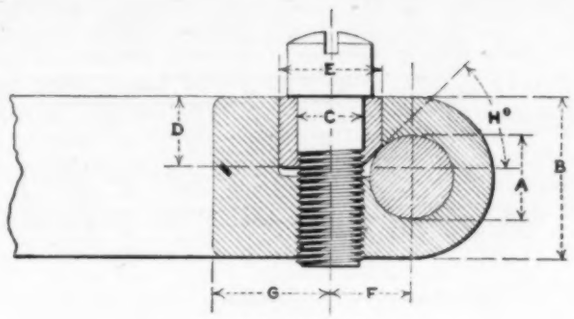
By George E. Hall

The accompanying illustrated tables of clamp collars and clamp studs have been used by the writer in the construction of automatic and semi-automatic machinery of light and medium weight. The methods shown in the illustrations have the combined advantage of simplicity and assured practicability in clamping shafts.



CLAMP STUDS

A	B	C	D	E	F	G	H	J
1/4	1/2	1/4	3/16	3/16	7/16	1	5/16	11/16
5/16	5/8	1/4	3/16	7/32	7/16	1 1/16	3/8	11/16
3/8	3/4	1/4	3/16	1/4	7/16	1 1/8	7/16	11/16
7/16	7/8	5/16	15/64	1/4	9/16	1 1/4	1/2	13/16
1/2	1	5/16	15/64	9/32	9/16	1 5/16	9/16	13/16
9/16	1 1/8	5/16	15/64	9/32	9/16	1 7/16	5/8	13/16
5/8	1 1/4	5/16	15/64	9/32	9/16	1 5/8	11/16	13/16
11/16	1 3/8	5/16	15/64	9/32	9/16	1 3/4	3/4	13/16
3/4	1 1/2	3/8	9/32	11/32	5/8	1 13/16	3/4	15/16
13/16	1 5/8	3/8	9/32	1/2	5/8	1 15/16	13/16	15/16
7/8	1 3/4	3/8	9/32	17/32	5/8	2 1/16	7/8	15/16
15/16	1 7/8	7/16	21/64	17/32	3/4	2 5/16	15/16	1 1/16
1	2	7/16	21/64	9/16	3/4	2 7/16	1	1 1/16
1 1/16	1 15/16	1/2	3/8	9/16	13/16	2 1/2	1	1 1/8
1 1/8	2 1/16	1/2	3/8	19/32	13/16	2 11/16	1 1/16	1 1/8
1 3/16	2 1/8	1/2	3/8	19/32	13/16	2 13/16	1 1/8	1 1/8
1 1/4	2 5/16	1/2	3/8	19/32	13/16	2 15/16	1 3/16	1 1/4
1 5/16	2 7/16	5/8	15/64	11/16	7/8	3 1/16	1	1 1/4
1 3/8	2 1/2	5/8	15/64	23/32	7/8	3 3/16	1	1 1/4
1 7/16	2 9/16	5/8	15/64	23/32	7/8	3 5/16	1 1/8	1 1/4
1 1/2	2 11/16	5/8	15/64	23/32	7/8	3 7/16	1 1/8	1 1/4
1 9/16	2 3/4	3/4	9/16	25/32	1	3 9/16	1 1/2	1 3/8
1 5/8	2 7/8	3/4	9/16	1	1	3 11/16	1 9/16	1 3/8
1 11/16	3	3/4	9/16	1 1/32	1	3 13/16	1 5/8	1 3/8
1 3/4	3 1/8	3/4	9/16	1 1/16	1	3 15/16	1 11/16	1 3/8
1 13/16	3 1/4	7/8	3/4	1 1/32	1 1/4	4 1/16	1 11/16	1 5/8
1 7/8	3 3/8	7/8	3/4	1 1/16	1 1/4	4 3/16	1 3/4	1 5/8
1 15/16	3 1/2	7/8	3/4	1 3/32	1 1/4	4 5/16	1 13/16	1 5/8
2	3 5/8	7/8	3/4	1 1/8	1 1/4	4 7/16	1 7/8	1 5/8
2 1/16	3 3/4	1	27/32	1 1/8	1 1/4	4 9/16	1 15/16	1 5/8
2 1/8	3 7/8	1	27/32	1 1/32	1 1/4	4 11/16	2	1 5/8
2 3/16	3 7/8	1	27/32	1 1/16	1 1/4	4 13/16	2 1/16	1 5/8
2 1/4	4	1	27/32	1 1/8	1 1/4	4 15/16	2 1/8	1 5/8
2 5/16	4 1/8	1	27/32	1 1/8	1 1/4	5 1/16	2 3/16	1 5/8
2 3/8	4 1/4	1	27/32	1 3/32	1 1/4	5 3/16	2 1/4	1 5/8
2 1/2	4 1/2	1	27/32	1 3/32	1 1/4	5 3/16	2 3/8	1 5/8



CLAMP COLLARS

A	B	C	D	E	F	G	H
1/4	3/8	8–32	3/16	9/32	5/32	5/16	45
5/16	7/16	8–32	3/16	9/32	3/16	5/16	45
3/8	1/2	10–32	3/16	9/32	3/16	5/16	45
7/16	5/8	1/4	1/4	11/32	1/4	3/8	45
1/2	3/4	5/16	5/16	11/32	1/4	3/8	45
5/8	1	3/8	3/8	11/32	1/4	3/8	45

Special Slide Rule for Machine Work

By W. E. Splain

One of the most useful devices that has ever been developed for the purpose of saving metal labor is the special slide rule. The merits of the device have been proved beyond a doubt, and yet, the majority of the people to whom slide rules could render valuable service, look upon them as toys for college students.

A special slide rule can be designed to solve any mathematical problem that can be written as an equation. Some rules are, of course, more difficult to design than others; however, they have been built to solve problems involving as many as nine variables. The answers obtained by this method of calculation are not absolutely correct because it is impossible to graduate and read the rule exactly, but in many cases the closely approximate result is accurate enough for all practical purposes.

Consider for a moment the problems that arise daily in a machine shop, that require only an approximate solution. Given the diameter of a piece of work in a lathe, how many r.p.m. must it make to give the required cutting speed? Reversing the problem, what must be the number of r.p.m. when the desired cut speed and the diameter are known? These problems arise every time a drill is used. When the r.p.m., feed and length of cut are known about a lathe, boring mill or drilling job, how much time is required to take the cut? When the conditions governing the hobbing of a gear are known, how long will it take to cut it? Many such problems are solved time and again in the course of a day around a machine shop.

One very useful special rule for machine shop work is shown in the accompanying illustration. It is graduated differently on both sides, and is especially useful to time-study men.

Suppose the diameter and the r.p.m. of a piece being turned in a lathe are known. Move the sliding member, shown in Fig. 1, to where the given values are opposite each other; then the arrow on the right will point to the cutting speed on the lower scale. If the diameter and desired cutting speed are known, place the arrow on the desired cutting speed and read the r.p.m. opposite the given diameter. If the diameter of the piece is less than 1 in., multiply it by ten and use the arrow

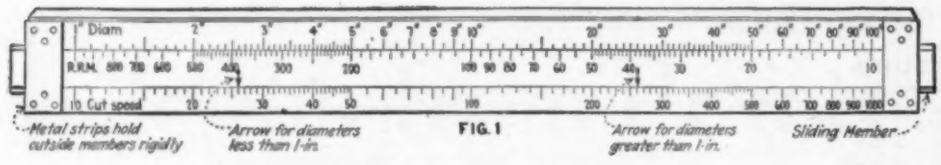


FIG. 1

Graduations should be not less than $\frac{1}{8}$ in. apart

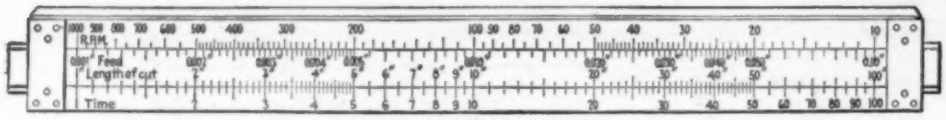


FIG. 2

FIG. 1—SPECIAL SLIDE RULE FOR CUT SPEED. FIG. 2—SIDE OF RULE FOR TIME CALCULATIONS

to the left to get the cutting speed. All such problems are computed for a drill in exactly the same way.

Suppose the feed, r.p.m., and length of cut are known about a lathe job. Slide the middle scale on the rule shown in Fig. 2 until the given feed is opposite the given r.p.m.; the time required to take the cut can be read directly opposite the given length of cut. This procedure can also be adapted to a drill, when the depth of the hole is considered as the length of cut.

The method of constructing the rule can be grasped from the illustrations. All the graduated scales are logarithmic scales of the same length. They can be obtained by copying the graduations on any standard slide rule. For shop use a rule 22 in. long overall is convenient and quite accurate.

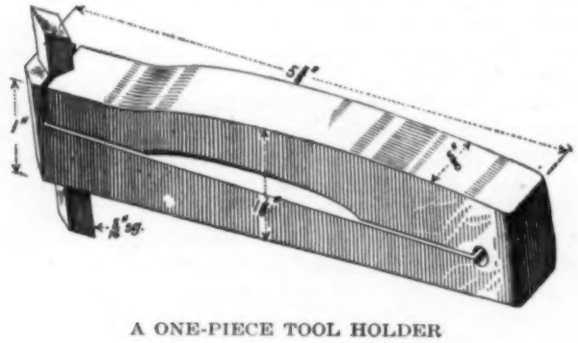
The time required to take a cut on a lathe or to drill a hole is about 10 per cent higher than the theoretical value. This discrepancy is due to belt slippage, slowing up of the driving motor or lineshaft, and similar causes. To make the rule shown in Fig. 2 take this error into consideration, shift the "time" scale to the left, making the 11-min. mark occur where the 10-min. mark would have been.

If reasonable care is taken in making such a rule as this, the instrument should be accurate within 2 per cent. Like all special slide rules that solve problems which occur frequently, this rule will more than pay for the effort required to construct it.

A One Piece Tool Holder

BY R. MCHENRY

The sketch shows a tool holder I have constructed that involves somewhat different principles than the usual tool of this class. It is made in one piece and has no clamping screw to break or get lost, and it holds the bit in an upright position so that the grinding for resharpening is done upon the end of the latter.



A ONE-PIECE TOOL HOLDER

It is made of machine steel and carbonized. The square hole is drilled and broached for the bit, at an angle of 10 deg. to the axis of the stock, before the sawing is done. The metal at the center of the stock is cut away with drill and file and this gives an opportunity to start the saw-cut, forward to the center line of the broached hole and back to the drilled hole near the rear end. The short saw-cut is then made along the center line of the broached hole to meet the horizontal cut.

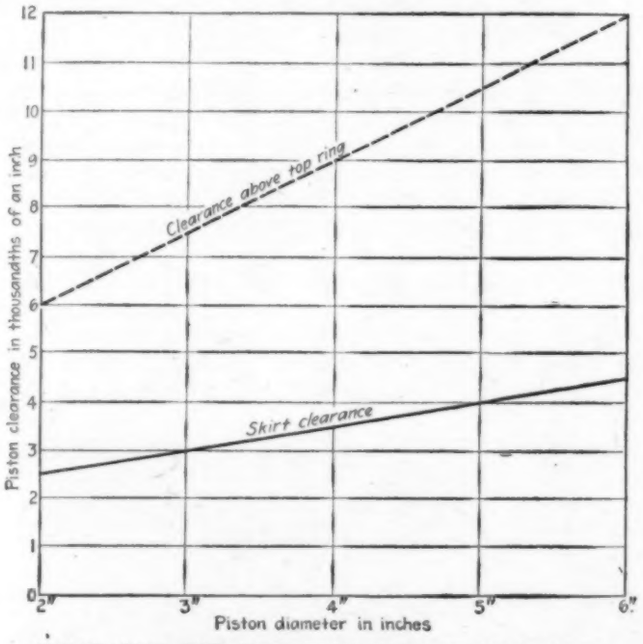
The clamping pressure to hold the tool bit is supplied by the tool-post screw of the lathe or other machine in which the tool is used. As the pressure of this screw comes on top of the crown, the upper part of the stock tends to elongate and bear firmly against the bit.

Automobile Piston Clearance

BY D. P. MUIRHEAD

It is often difficult to find out what is the necessary clearance to give new pistons which are being fitted to reground cylinders in automobile engines. The accompanying diagram is given in the hope that it may prove useful in such cases. It is laid out only for engines that are fitted with cast-iron pistons and the cylinders of which have been provided with means for cooling by water.

The upper dotted line gives the clearance for that portion of the piston above the top ring, and the lower



CLEARANCE FOR CAST IRON PISTONS IN WATER-COOLED CYLINDERS

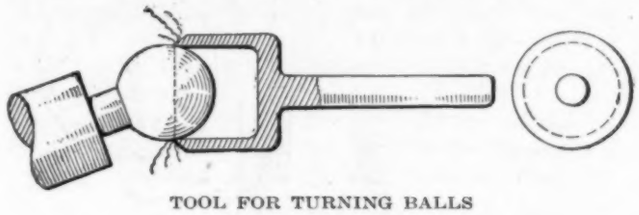
line gives the clearance for the skirt portion. In the majority of pistons it will be found that the skirt has been ground parallel up to the top ring, but above the top ring, the piston has been further reduced to allow for the extra expansion due to the higher temperature at this point.

A Tool for Finishing Balls

By H. L. WHEELER

It is sometimes desired to turn a quantity of balls on the ends of rods or handles, and when the number to be produced does not justify expensive tooling for the job, the hand tool shown herewith will be found to answer the purpose admirably, although its use demands a considerable degree of skill on the part of the operator.

The spherical surface is first roughed out in a lathe by manipulating a single point tool (held in the tool post) with the carriage and cross-feed handles and the ball finished as nearly as practicable to a templet, with a view to leaving as little stock as possible to be taken off with the finishing tool. When this operation



TOOL FOR TURNING BALLS

is completed the finishing tool is applied in the manner shown in the sketch.

The bore of the tool should be just equal to the finished size of the ball. The wall should be about $\frac{1}{8}$ in. in thickness. The tool is durable, as it can be resharpened many times by grinding the outside bevel without altering the size of the bore.

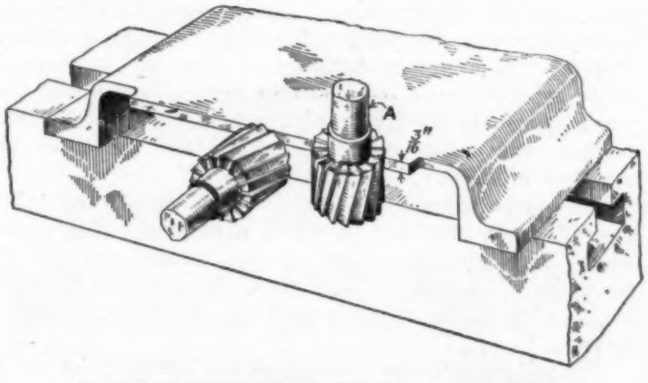
A skilful operator can produce perfect work with an excellent finish and true to size. Heavy cuts should not be attempted as the tool is intended only for finishing purposes.

A Troublesome Milling Job–Discussion

By A. CHESTER

On page 352, Vol. 57, of the *American Machinist*, J. C. Adams shows how he avoided trouble in milling a thin, springy piece of cast iron by changing from a $\frac{3}{4}$-in. end milling cutter to another of the same type but of $2\frac{1}{2}$ in. diameter, the difference being that whereas the smaller cutter exerted both an upward and a downward pressure that caused the work to vibrate, the larger one exerted practically all of its pressure in a direction lengthwise of the work.

Mr. Adams would have secured even better results if he had used the same type of cutter in the spindle of



MILLING THIN WORK WITH AN END MILL

the vertical attachment as shown at *A* in the reproduction of his sketch presented herewith. Under this condition there would be no tendency at all for the work to spring and he would have the advantage of being able to use the entire length of the cutting edge at each grinding by simply raising the table of the machine a distance equal to the thickness of the work whenever that particular part of the cutter became dull.

A Problem in Shop Trigonometry –Discussion

By M. TOLLIVER

I desire to apologize most humbly to Edward J. Rantsch for having misconstrued in my discussion on page 971, Vol. 57 of *American Machinist*, the problem in his article on page 733. The only excuse I can offer for my mistake which he criticizes on page 194, Vol. 58, is that I am not a mind reader. I put it up to every fair-minded man whether he would really think that Mr. Rantsch is speaking about a problem in trigonometry in school when he says, "In this case it was required to make a piece with a groove." He said several other things which made me believe that all he wanted to do was to make the piece. I am better informed now and yet I confess that I don't see at all why Mr. Rantsch insists on presenting this piece of trigonometry because trigonometry is not at all required in the problem, neither for the making of the piece itself nor for the finding of its dimensions.

In the accompanying illustration which is similar to the one Mr. Rantsch gave on page 733, Vol. 57 of *American Machinist*, let us call the radius of the large circle R and of the small circle r. Then the line

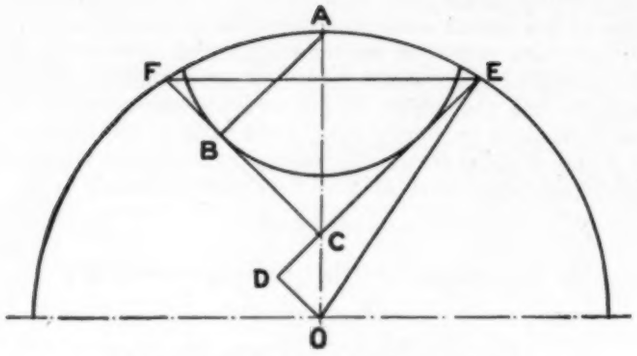
$$AB = r$$
$$AC = r\sqrt{2}$$
$$CO = R - r\sqrt{2}$$
$$DO = \frac{R - r\sqrt{2}}{\sqrt{2}} = \tfrac{1}{2}\,(R - r\sqrt{2})\,\sqrt{2}$$
$$DO = DC$$
$$ED = \sqrt{EO^2 - DO^2}$$
$$ED = \sqrt{R^2 - [\tfrac{1}{2}\,(R - r\sqrt{2})\,\sqrt{2}]^2}$$
$$ED = \sqrt{\tfrac{1}{2}\,R^2 + Rr\sqrt{2} - r^2}$$
$$EC = ED - DC$$
$$EF = EC\sqrt{2}.$$

Applying this general solution to the problem in question, we substitute $\frac{15}{16}$ for R and $\frac{15}{32}$ for r. In order to avoid fractions we calculate everything in thirty-seconds so that $R = 30$ and $r = 15$. We find that

$$ED = \sqrt{\tfrac{1}{2} \times 30^2 + 30 \times 15\ \sqrt{2} - 15^2}$$
$$ED = 29.3495$$
$$DC = \tfrac{1}{2}\,(R - r\sqrt{2})\,\sqrt{2} = \tfrac{1}{2}\,(30 - 15\sqrt{2})\,\sqrt{2}$$
$$DC = 6.2133$$
$$EC = ED - DC = 29.3495 - 6.2133$$
$$EC = 23.1362$$
$$EF = EC\sqrt{2}$$
$$EF = 23.1362\sqrt{2} = 32.7192.$$

Dividing each dimension by thirty-two to secure the length in inches.

$$DC = 0.19416 \text{ in.}$$
$$EC = 0.7230 \text{ in.}$$
$$EF = 1.02247 \text{ in.}$$



A PROBLEM IN SHOP TRIGONOMETRY

The dimension *C* to which Mr. Rantsch refers is the radius *R* and is one of the quantities known in the first place.

As Mr. Rantsch will see, no trigonometry is required, which is some advantage if a man doesn't happen to have trigonometrical tables in his pocket. It is so much easier to get hold of a piece of paper and a pencil than of a trigonometrical table.

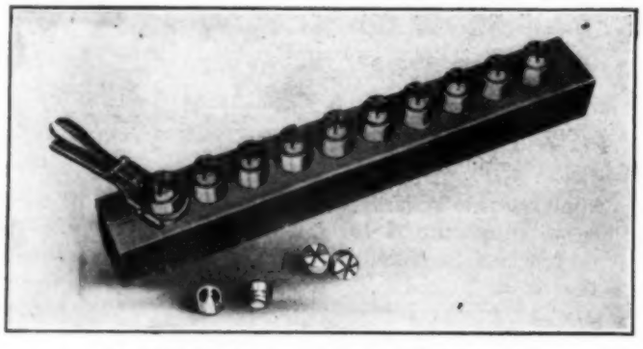
Unless Mr. Rantsch considers his problem as one given by a professor to his pupils in school I fail to see why he wants the problem at all. Neither the layoff nor the calculations of the various lines and points of the problem require the use of trigonometry.

I conclude by once more apologizing for my lack of mind reading ability.

Fixture for Slotting Brass Plugs

BY HENRY BARR

We make a large number of brass plugs like the ones shown in the foreground of the illustration. As can be seen, the tops of these plugs are divided into six parts, necessitating three saw cuts completeley across each plug top. We do these, ten at a time in a milling ma-



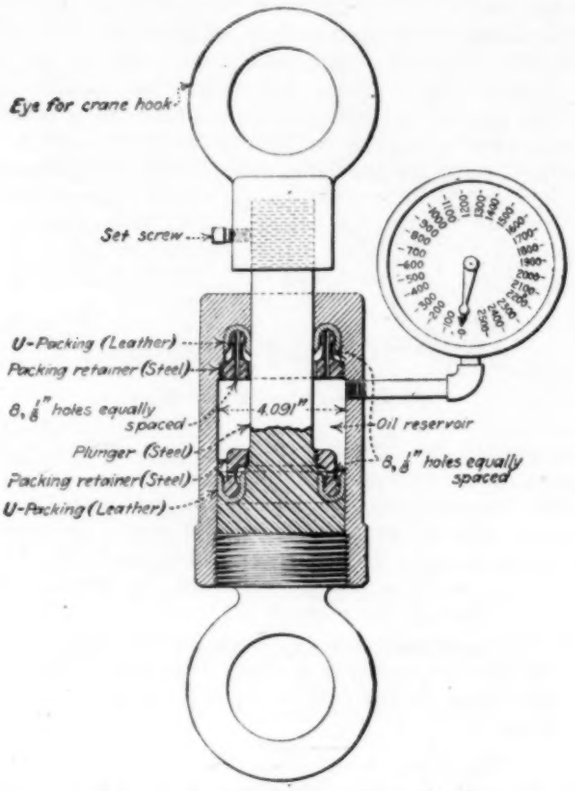
FIXTURE FOR SLOTTING BRASS PLUGS

chine, using the fixture shown. Each plug, which is threaded in the screw machine before being cut off the bar, is screwed into a hollow threaded sleeve on the bottom of which is a gear of such a size as to mesh snugly into the gear on the next sleeve. Thus all the plug holders are geared together and move as the locking lever at the left is moved. After the slitting saw has been over all the plug ends, the table is run back, the locking lever moved around one notch and another cut is taken. Once more this is repeated and the job is done.

Device for Determining Crane Loads

BY WM. W. BURRELL

In assembling heavy machinery it is very desirable at times to know the magnitude of the pull exerted by a crane when placing or lifting heavy parts of a machine. Regardless of how skillful a crane operator may be, there is sometimes danger of injury to the parts to be



DEVICE FOR WEIGHING CRANE LOADS

assembled by too much crane power and it is often desirable to predetermine the applied load.

The writer was up against a proposition in assembling large cylinders which were to be joined by threaded ends. The cylinders were assembled vertically, the lower cylinder being clamped to the floor and the upper cylinder suspended from a crane. As the cylinders were heavy, considerable difficulty was experienced in screwing the suspended cylinder into the lower one due to having no way by which to judge the crane loads. When the pull on the crane was too much or too little the turning moment was so great as to destroy the alignment of the cylinders. After repeated efforts in trying to overcome these difficulties a weighing device, described herein, was designed and made. It worked so successfully that it is now in general use about the works, not only for weighing crane loads, but for cable testing and other purposes where the loads to be weighed are heavy.

The device consists primarily of a cylinder containing lubricating oil and in which a moving piston operates. A slight movement of the piston sets up oil pressure within the cylinder which is conveyed through an opening in the cylinder wall to a hydraulic pressure gage.

The weighing device was suspended between the crane hook and the load to be lifted or cable to be tested,

so that any load on the crane was transmitted through the device introducing a pressure in the oil directly proportional to the load. The device, as shown in the sketch, was designed for a maximum lift of 20,000 lb. and had a net piston area of 10 square inches.

As the gage registered pressure per square inch and the net area of the piston was 10 sq.in., one had simply to add a cipher to the gage reading to determine the load or lift of the crane.

To Avoid Computing Errors

In the design of weighing devices of much greater capacity, in order to keep down excessive oil pressure, the net area of the piston was increased to 20 sq.in. To avoid error in computing, a paper dial with the corresponding graduations multiplied by twenty was laid down and pasted over the original gage dial. The load in pounds could then be read directly from the gage.

Referring to the sketch, the operations may be described as follows:

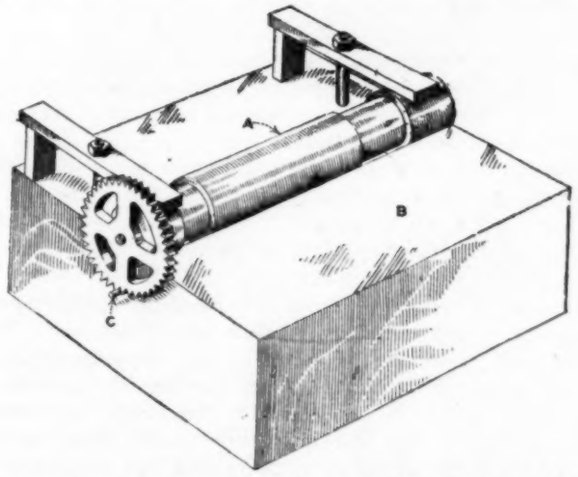
Assume one ring of the weighing device suspended from the crane hook, and the load to be determined secured to the other ring. When the crane starts to hoist, the piston being suspended from the crane hook, has a tendency to move in the cylinder. In order for the piston to move it must displace the oil ahead of it and, as there is no orifice for the oil to escape, the result is that a pressure is set up in the oil within the cylinder wall. The gage registers the pressure, thus denoting the magnitude of the lift.

Improvised Method of Making Small Gears

By Charles Janney

On some special work that I was doing I needed some very small gears, ½ in. in diameter ⅛-in. face, with 20 teeth. Being unable to buy such gears I proceeded in the following manner to make them.

First I went to the local jeweler and procured a clock



MAKING SMALL GEARS FOR EXPERIMENTAL WORK

wheel that was about ⅛ in. in diameter and had 40 teeth. I then put a ½-in. brass rod in the collet of my lathe and turned a piece as shown at *A* in the sketch, with the small projection at one end a tight fit in the bore of my clock wheel. Next I made a V-block with small clamps as shown at *B*, to hold the work in the shaper vise.

Driving the clock wheel on the projecting end of the turned brass piece, I laid the latter in the V-block with the clock wheel overhanging one end and drilled in for a small pin as at *C* to engage with the teeth of the wheel.

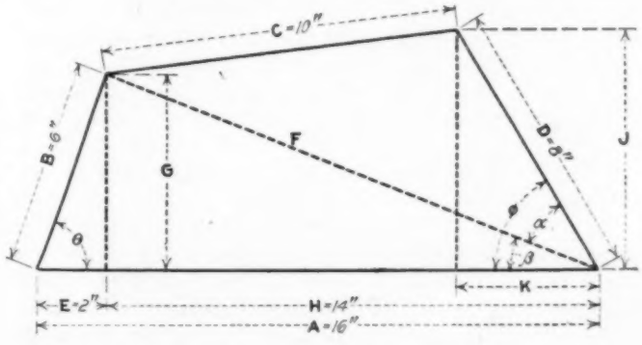
I then made a tool bit the shape of a tooth space of a 20-tooth gear, and with the V-block in the shaper vise and the tool bit in an Armstrong holder, I planed in the first space. The remainder of the teeth were indexed by loosening the clamps and turning two teeth of the clock wheel past the locating pin each time.

The smooth shoulders at the end of the brass piece were for the clamps to bear on. The teeth were cut on the longer shoulder at the middle. When the teeth were all cut the piece was returned to the lathe collet, bored to suit, and the gears parted with a thin parting tool.

An Interesting Shop Problem—Discussion

By F. M. Stinson

In the problem under the above title which appeared on page 1005, Vol. 57, of *American Machinist*, it must be admitted that H. W. Hardy has presented a very pretty solution. But time is money in the shop as elsewhere, and in working out this problem a more direct method would have saved much figuring. The dimensions *G* and *J* in the accompanying illustration are the distances required. Squaring 6 and 2 and subtracting the results, we get 32. Our handbook tells us that



AN INTERESTING SHOP PROBLEM

the square root of 32 is 5.6569. Thus we have *G* without putting pencil to paper. To find *J* we proceed as follows:

$$\tan \beta = \frac{G}{H} = \frac{5.6569}{14} = 0.40407$$

$$\beta = 22 \text{ deg.}$$

$$F = \frac{H}{\cos \beta} = \frac{14}{0.92718} = 15.0995 \text{ in.}$$

$$\cos \alpha = \frac{D^2 + F^2 - C^2}{2DF} = \frac{8^2 + 15.0995^2 - 10^2}{2 \times 8 \times 15.0995}$$

$$\cos \alpha = 0.7947$$

$$\alpha = 37 \text{ deg. } 22 \text{ min.}$$

$$\phi = 37 \text{ deg. } 22 \text{ min.} + 22 \text{ deg.} = 59 \text{ deg. } 22 \text{ min.}$$

$$J = D \sin \phi = 8 \times 0.86045 = 6.8836 \text{ in.}$$

American Machinist
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KENNETH H. CONDIT AND FRED H. COLVIN
Editors
March 1, 1923

The Debt of the Small Shop to the Large One

A SUBSCRIBER writing an otherwise appreciative letter to us, remarks that the *American Machinist* can do the greatest amount of good by the description of methods applicable to the medium-sized shop, with, say 200 or 250 men. The methods of the larger automobile shops, he says, make interesting reading but do not help the smaller shop where the product is not so uniform, is not made in such large quantities and where there is no large staff of highly paid experts who can spend large sums of money without wrecking the company, provided they succeed in a measure.

Our correspondent's remarks cannot well be contradicted if immediate results only are considered. But did it ever strike him, does it strike most of us, that these large plants are the laboratories in which our present day methods have been developed and which are now developing the methods that will be used in the small shop in the course of a few years?

Does our friend use an automatic screw machine or a gear hobber, die castings or drop forgings, high speed steel or motor drives? Few of these things would belong in the daily life of the smaller shops if the big brother with the larger organization and the bigger money bag had not wasted a few thousand dollars in testing them out.

The description of methods in the larger shop is not equivalent to a recipe for operations in the small ones but it gives food for thought. It makes the small shop acquainted with methods and tools and machines which otherwise would remain unknown. The man in the small shop may have the same knowledge, ingenuity and hustle as the expert in the big factory, but unless he feels somewhere near 100 per cent sure of his idea he does not dare to carry it out.

Though it is a matter of history that the big shop has developed from the small one, it is also true that, at the present time, progress in the small shop depends largely on the initiative of the big one.

Careless Addressing May B e an Expensive Luxury

ACCORDING to the Postmaster General the directory service in the post offices which is occasioned by insufficient addresses involves a loss of nearly two million dollars every year. He claims, and we are inclined to agree with him, that half of the advertisements published in newspapers and periodicals omit the street and number of the advertiser.

In any but the smallest post offices street addresses must be looked up in a directory and the letter is thus delayed from eight to twenty-four hours.

The same omission of street and number may be noticed on many letterheads and the resultant delay and expense differ no whit from that just mentioned. Of course, it gives an impression of size and importance, and tickles one's vanity to put out a letterhead that says "John Jones, Detroit, U. S. A.," but it costs time and money to do it.

So long as the post office has to stand the expense most of us would have little concern over the result of our laziness. But now the Postmaster General threatens to ask Congress to put a one-cent penalty on each letter on which the street and number are not given, unless the burden can be lightened by public co-operation. This puts the shoe on the other foot and makes it more to our own interest to take pains in seeing that addresses are complete and correct. A little effort now may save considerable annoyance later. Shall we make it?

Setting Aside the Will of the People

THE MOST recent example of Senatorial impotence, the ship subsidy filibuster, calls attention once more to the enormous wastes incident to democratic government. Our opening sentence may sound like a shot fired by a red-eyed anarchist but it does not indicate on our part any lack of faith in our form of government. On the other hand, we feel no hesitancy in remarking on failures of government agencies to function in the public interest.

A legislative body must of necessity deliberate before acting upon bills that are presented to it. As a matter of fact, our legislatures in the United States pass entirely too many laws. If they could be curbed our courts would have to waste less time passing on the constitutionality of ill-considered acts.

On the other hand, any body which so hampers its actions by intricate and unbreakable rules that it cannot bring popularly supported legislation to a vote, is failing to function. The famous filibusters of Senate history have sometimes killed good bills, sometimes bad ones, but in any case they have wasted much valuable time that should have been spent in constructive consideration of needed legislation.

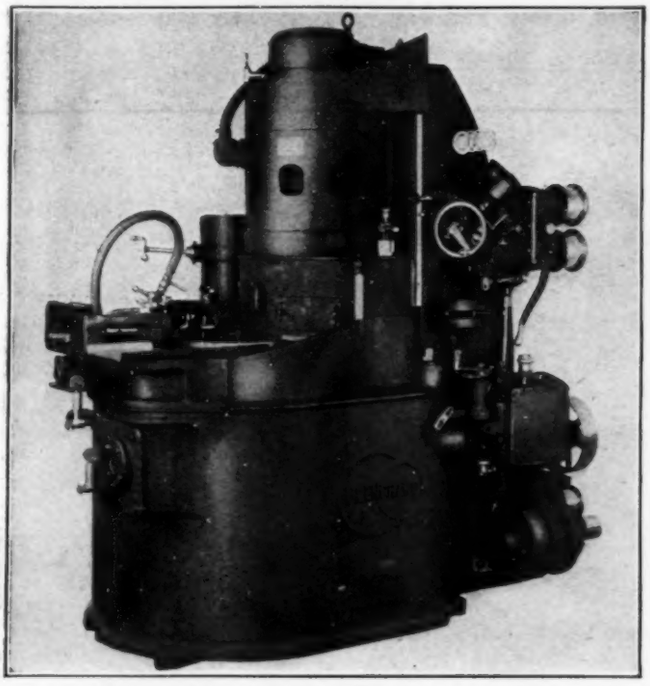
Whether the ship subsidy bill passes or is lost—the result is in doubt as this is written—the principle is the same. No bill so urgently needed by any considerable group of citizens should be prevented from coming to a vote by any such means.

We are all suffering from the reaction against preparedness which normally follows any great war. We should not, however, be blind to the consequences of having no merchant marine when another war overtakes us. There are two very definite handicaps we would have to face. Our foreign trade would have to be carried in ships of other nations and our navy would be practically helpless without a service of supply. If we were called upon to send an expeditionary force overseas where would we be? The thought of war is abhorrent but playing ostrich will not prevent war.

Shop Equipment News

Blanchard No. 16-A Automatic Surface Grinding Machine

The Blanchard Machine Co., Cambridge, Mass., has recently developed the No. 16-A automatic grinding machine, having the same capacity as the No. 16 plain machine. It is, however, not the plain machine with automatic attachments, as it is a completely new design. The machine is automatic in every respect and adapted especially to quantity production of small work, such as pipe wrench frames, roller and ball bearing races, clutch cams and mower blades. Front and rear views of the machine, shown in Figs. 1 and 2, give an idea of the size and proportions.



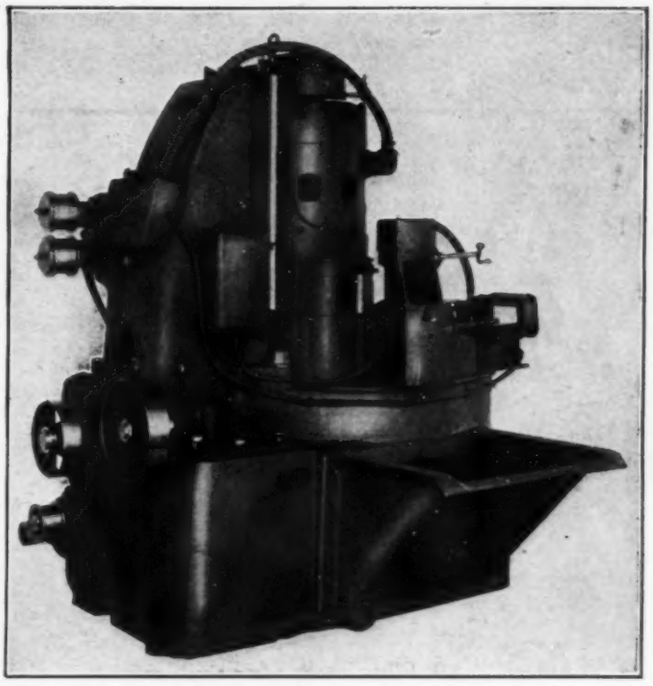


FIG. 1—BLANCHARD NO. 16-A AUTOMATIC SURFACE GRINDING MACHINE. FIG. 2—REAR VIEW OF BLANCHARD NO. 16-A MACHINE

The operator's task is completed when he has placed the work on the machine. The machine automatically grinds the work to size, measures the work, controls the adjustment of the wheel-head, unloads, and demagnetizes the work, all without the operator's attention. An automatic washing machine may be added, so that the work is delivered to holding receptacles washed as well as demagnetized. The operator's duty is to stand at the loading station and lay the work continuously on the revolving chuck.

It will help in understanding the operation of the machine to follow for one grinding operation the course of a piece through the machine. Reference to Fig. 3 will aid in this examination. At the loading position where the piece is first laid on the rotating magnetic chuck, there is no magnetism and the piece starts around with the chuck, held in place by its own weight. Just before the piece reaches the waterguards it is held magnetically and, passing through an opening in the guards, is carried under the wheel, which has been accurately adjusted to height by gaging the preceding pieces.

In passing under the wheel, the piece is ground to size, and then it passes out through the waterguards and under the wheel-control caliper, which automatically sets the wheel-head to compensate for any wheel wear which has just occurred, and which is evidenced by the large size of the work. After the piece has passed the caliper the chuck becomes non-magnetic, and the piece leaves the chuck, passes through a demagnetizer and thence down a chute to the holding receptacles.

After the piece has been removed, the chuck surface is washed with water and cleaned, so that it reaches the loading position clean and dry. The operation is continuous, the pieces are placed one after another on the chuck and form a continuous chain of work.

When producing up to 1,200 surfaces per hour one operator only is necessary per machine. When producing in excess of this quantity, part of the time of one helper may be needed to help handle the large volume of work. One helper can serve three or more machines.

The rotating magnetic chuck is of one-piece steel construction and like other Blanchard magnetic chucks, is waterproof. The chuck is magnetic under the wheel and caliper only, which result is accomplished very

simply and without the use of sliding or moving contacts of any kind. The wheel-control caliper also is of simple, sturdy construction.

The wheel spindle is supported on ball bearings throughout, and the head is of even heavier construction than on the plain No. 16 machine.

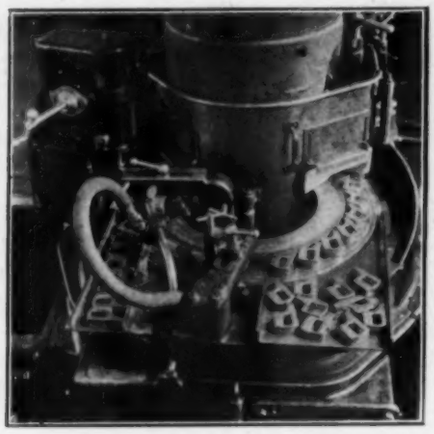


FIG. 3—TOP VIEW, WITH DEMAGNETIZER REMOVED

The demagnetizer, connected to the motor circuit, starts and stops with the motors, and is of simple construction. The members of the machine are constructed for withstanding continuous service with heavy cuts.

All controls are conveniently placed within easy reach of the operator. All important bearings and gears are lubricated by oil baths. Waterguards prevent splashing of the coolant. The base forms a tank for 180 gallons of coolant and also acts as a settling pan, from which the chips may be removed with the machine operating.

Ames No. 55 Simplified Dial Gage

The simplified dial gage or indicator shown in the accompanying illustration is a recent addition to the line of gages produced by the B. C. Ames Co., Waltham, Mass. It embodies several marked improvements in construction and design over the previous type, such as simplicity, durability, accuracy and interchangeability.

The No. 55 dial gage has only 39 parts in all, as compared with 55 parts in the No. 5 gage made by the same firm. Simplicity has been gained by putting both the rack wheel and the take-up wheel with the spring all on one large staff, and thus using only one bridge to support these parts and the center pinion. The design of the bezel eliminates other parts such as lugs and lug screws, since the bezel is held onto the case by one piece of spring brass wire. The elimination of these parts has made the mechanism more durable and accurate since there are fewer parts to wear, break, get out of order or replace.

The gage can be badly abused and yet retain its smooth spindle action and accuracy. The manufacturer claims that it can be dropped from a height of 5 ft. or even more to the floor, so that contact is applied to the plunger, without injury to the instrument; and that the case may be battered out of shape, and still the gage will function perfectly. This is made possible chiefly because the wheel staff is very large and the spindle is so designed that the shoulder thereon comes in contact with the top of the case to receive the shock.

A tolerance of only 0.0005 in. plus

AMES NO. 55 DIAL GAGE

or minus is allowed in the entire spindle travel, and any gage showing a greater inaccuracy is rejected at the factory. All parts are made with jigs and to standards, so that parts substituted at any future time will fit perfectly. The screw and other parts have all been constructed larger than before, thus making assembling and disassembling easier and simpler.

The bridge is made of thick pressed brass and the guide block of solid brass. The case and back are similar to those on the No. 5 gage. The spindle travels 0.3 in. The dial is usually graduated into 100 parts, reading 0.050 in. each way. By using a special rack wheel, the dial can be divided into 50 parts, the marks being twice as far apart. Special dials and spindles can be supplied.

Combustion Control Co. Automatic Temperature Control for Oil Furnace

The Combustion Control Co., Otis Bldg., Philadelphia, Pa., has recently developed a type of temperature and pressure controller to be used in connection with heating and heat-treating furnaces where oil is employed as fuel.

The control is of the solenoid-operated type with constant stroke, but arranged for the widest range of adjustment to meet a variety of conditions. The dual control and dual adjustment mechanism, shown in Fig. 1, is mounted on a central housing and consists of two separate bodies, one for oil and the other for air or steam. Each of these bodies has an independent by-pass and auxiliary regulating valve.

The housing also forms a base on which the solenoid frame and its lever connections are mounted. A shaft extends vertically through the housing, connects with the solenoid levers at its upper end and has an adjustable cross bar mounted on it at the lower end.

The cross bar carries the auxiliary valves and operates them in unison. It is adjustable for stroke, to control the admission of the fuel oil and the air or steam for atomization. The adjustment is made by handwheels and is provided with indicators and a vernier for setting or resetting for different loads or conditions. The air or steam valve is provided with an independent adjust-

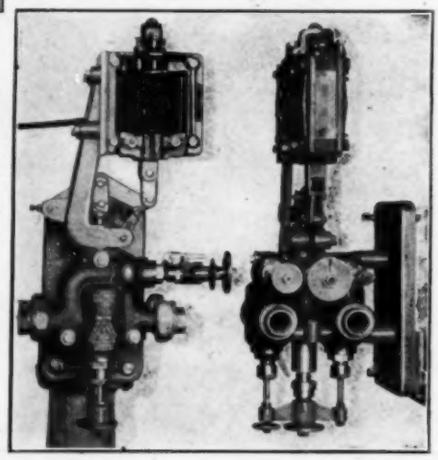


FIG. 1—COMBUSTION AUTOMATIC DUAL TEMPERATURE CONTROL

ment to secure proper atomization. The steam valve is of the balanced type and the oil valve has an angular porting to give close adjustment and regulation. The by-pass valves are mounted on the sides of the bodies

in much the same manner as the auxiliary valves.

The operation is as follows. Assuming that a temperature of 1,500 deg. F. is desired, the temperature indicating and control pyrometer shown in Fig. 2 is set at that point. The by-pass valves are then regulated to furnish sufficient oil and air or steam for atomization to bring the furnace temperature up to and hold it at about 1,495 deg. When the load is now introduced, the temperature drops and the "low"

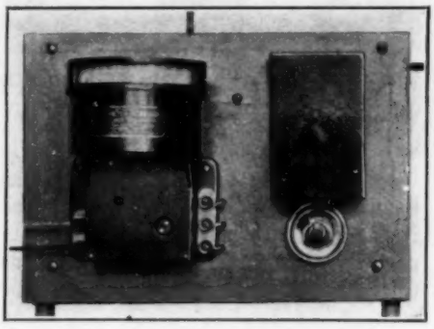


FIG. 2—COMBUSTION TEMPERATURE CONTROL PANEL

contact in the pyrometer controller is made. Then, by means of relays, the solenoid is energized and the auxiliary valves are opened, adding more fuel with air or steam.

The added fuel causes a rise in temperature to the desired point, 1,500 deg., at which point the pyrometer control will make "high" point contact. The circuit is then opened by means of relays, which allows the solenoid plunger to drop and shut off the fuel supply. The cycle is repeated as the temperature fluctuates within the range in which it can be held by the controller.

Excessive temperatures are provided against by means of temperature fuses that open the circuit and close the control when the maximum desired temperature is exceeded, so that only the minimum amount of fuel is supplied. The valve will also close to this point whenever the operating current fails. An emergency rest is provided, so that hand regulation can be made.

The control can be operated in conjunction with any of the standard pyrometric controllers, such as are used for signalling by bells or colored lights. Attachments can be provided to control the supply of air for combustion where certain atmospheric conditions must be maintained in the furnace.

These attachments are not included as parts of the regular equipment.

The control mechanism is made in $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1 and $1\frac{1}{4}$ in. sizes. The $\frac{1}{4}$, $\frac{3}{8}$ and $\frac{1}{2}$ in. sizes are mounted on one housing, and any combination of the three sizes can be used so as to meet conditions. The $\frac{3}{4}$, 1 and $1\frac{1}{4}$ in. sizes are also standardized in the same manner.

Kingsbury Automatic Drilling Machine with Indexing Fixture

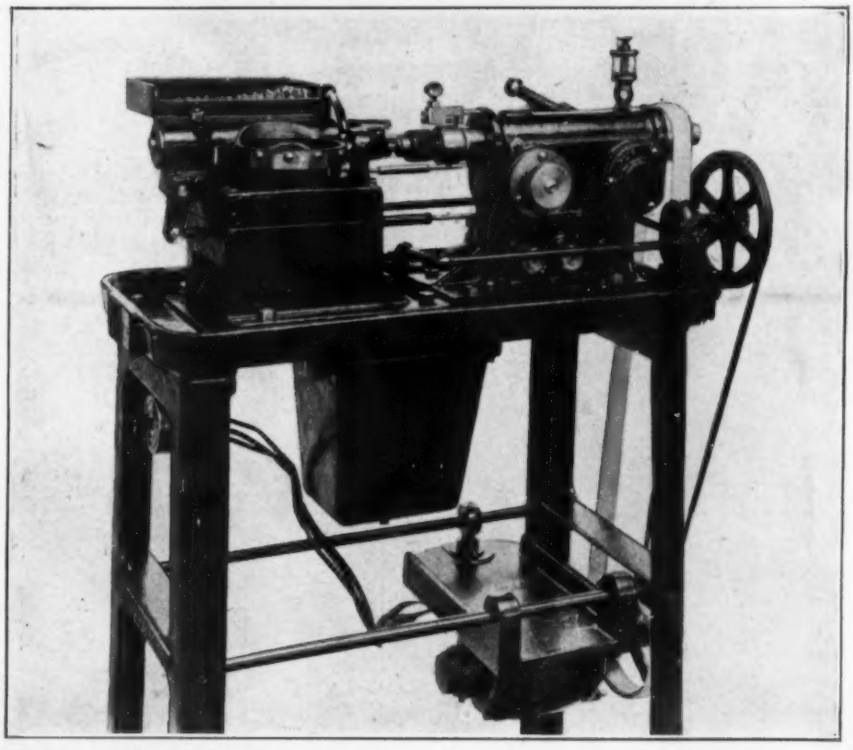
The Kingsbury Manufacturing Co., Keene, N. H., has developed an automatic indexing fixture for use on automatic drilling machines. The fixture is here shown used in conjunction with the No. 8 automatic sensitive drilling machine, described on page 666, Vol. 57, of *American Machinist*. This complete unit is designed for cross drilling small work such as binding posts, rivets and also irregularly shaped pieces. On work of this kind it ordinarily takes as long if not longer to change the work as it does to drill it. The dial feed on the device reduces this time to a fraction of a second, while the drilling is still accomplished as rapidly as on a high-speed hand machine.

This recent addition is called the No. 59 automatic indexing fixture. It has a dial, containing twelve stations, which is indexed by means of a cam cut on the friction cam wheel which controls the feed of the drill. The machine will stop at the completion of each cycle before indexing, or the trip lever may be locked in its disengaged position and the machine will run entirely automatically. The operation is as simple as that of a power punch press equipped with a dial feed.

The work is laid on the dial, which has stations shaped to suit, and is automatically clamped in the drilling position. The clamping jaw is mounted on a substantial plunger and is held in alignment by means of a hardened bushing sliding on a hardened and ground pin. The work is clamped from the back under spring pressure.

Where the nature of the work will permit, the work can be ejected readily from the dial after it has passed the drilling position; and it is claimed that it is an easy matter to keep the dial fed to produce at the rate of 35 pieces a minute, at a spindle speed of 400 r.p.m., when small short holes are drilled and the material is soft, like brass. As the drilling time adjusts itself automatically to conditions, the operator need give no attention to feed adjustments.

The machine is furnished fully equipped with a lubricating pump and $\frac{1}{4}$-hp. motor. The position of these units on the frame of the machine can be seen in the illustration.



KINGSBURY AUTOMATIC DRILLING MACHINE HAVING AN INDEXING FIXTURE

Heald Double-Head Internal Grinding Machine

The Heald Machine Co., Worcester, Mass., has recently completed an adaptation of its No. 70 internal grinding machine to carry two wheel heads and thus grind long holes at both ends simultaneously. The arrangement is intended to insure parallelism and uniformity of size of the two ends of a part. The machine has many applications, one of which is the grinding of the bores of cluster gears used in automobile transmissions.

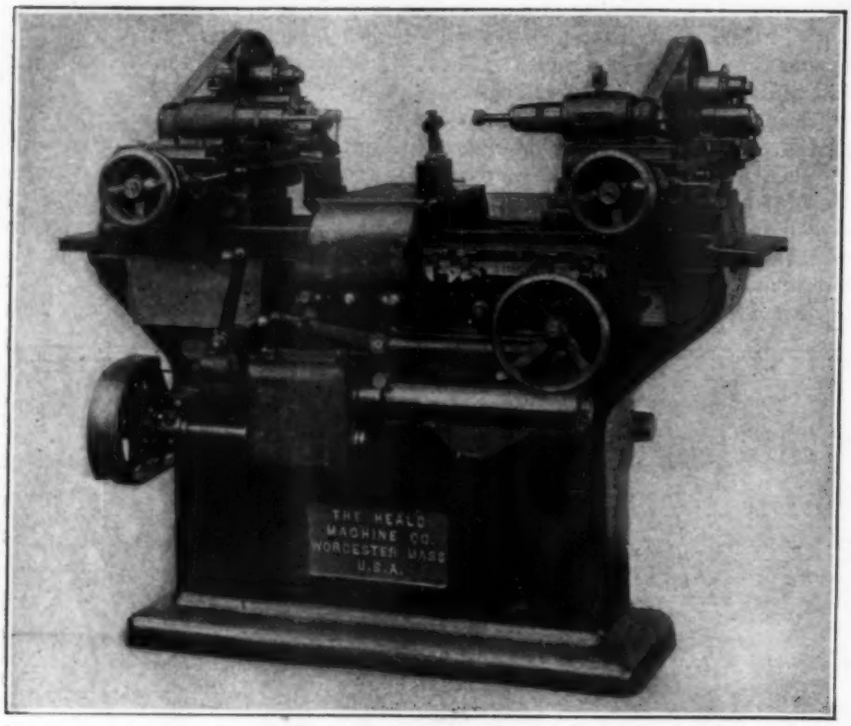


FIG. 1—HEALD DOUBLE-HEAD INTERNAL GRINDING MACHINE.

The machine, shown in Fig. 1, is of the same capacity and specifications as the regular No. 70 except that it has a long table adapted to carry a wheel head at each end. No other change is required to convert the machine than to provide the long table and a "left-hand" wheel head, in the construction of which the same parts are used as in the regular head.

The work-head bridge is a special casting and is placed at the center instead of at the left end of the machine, as in the usual construction. From the nature of the work the machine is called upon to do, it is necessary to design a special work head for each adaptation.

In Fig. 2 the machine is shown fitted with a Garrison chuck for holding a cluster gear of the sort to be seen at the right, by contact on the teeth at the pitch circles of the end gears. The chuck is mounted in a specially designed housing and is rotated by means of a narrow belt from the overhead countershaft, leaving both ends of the cluster gear accessible to the grinding wheels.

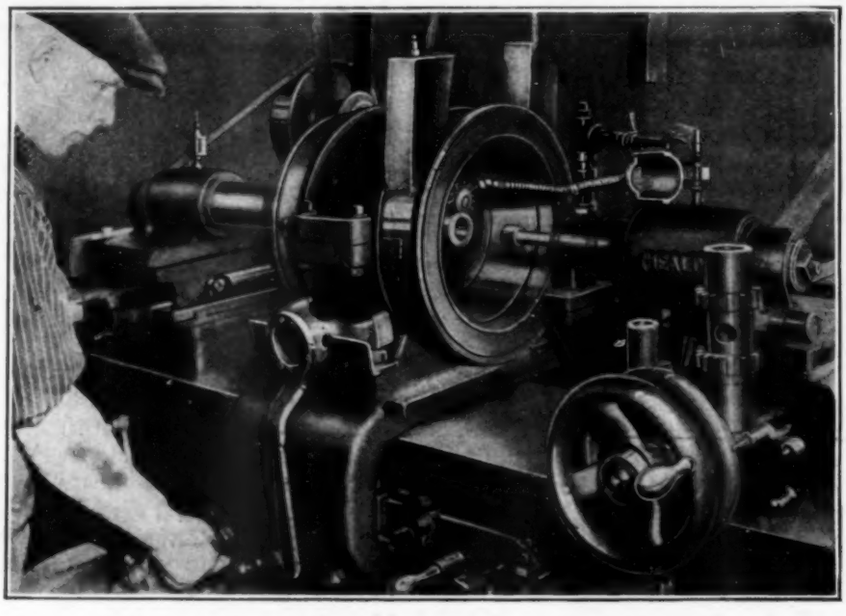


FIG. 2—SPECIAL GARRISON CHUCK FOR CLUSTER GEARS

Samples of the work ground upon the machine are shown in Fig. 3. The bores are recessed in the middle, leaving a bearing at each end only; and the work makes an ideal job for a machine of this type, as it obviates the necessity for releasing, turning around and remounting each piece after the first end has been ground.

Since both wheel heads are mounted upon one table and move in unison, one wheel enters the work at one end as the other wheel is leaving the opposite end. Each wheel head is independently driven and has its individual cross feed and sizing mechanisms, which are the same as upon the standard machines. The central bridge is stationary and serves only as the mounting for the work-holding and driving fixture.

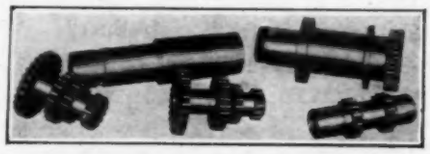


FIG. 3—SAMPLES OF WORK GROUND UPON THE MACHINE

"Auto-Hone" Cylinder Finishing Tool

A portable honing tool for automotive engine cylinders has recently been devised by the Auto-Hone Co., Inc., Buffalo, N. Y. The tool is suitable for refinishing in repair work on automobile, tractor, or gas engine cylinders, as well as being applicable for manufacturing processes in which honing can be employed.

The hone is made in two sizes for cylinders from 2⅛ to 4½ in. in size.

The "auto-hone," as shown in the illustration herewith, consists of a center arbor of cast aluminum carrying on its circumference honing stones. The stones are held in trays and their position is adjustable between certain minimum and maximum limits. Because of their length of 8 in., the stones bridge the area of wear and grind the full length of

AUTO-HONE CYLINDER FINISHING TOOL

the cylinder wall until all traces of ring travel, scoring, out-of-roundness and taper disappear. Pressure on the stones is regulated from the driving end of the tool. As there is an even, adjustable spring pressure radially behind the stones and as the speed of the tool is relatively high, a true cylindrical surface is made. Two sets of stones are provided, one for quick cutting and the other for fine honing. The driving shank can be attached to an ordinary portable electric or pneumatic drill.

For repair work on engine cylinders, the cylinder heads and pistons are removed. Then the auto-hone is slipped into the cylinder, connected with an electric drill and rotated. It is claimed that the usual 0.005 to 0.007 in. out-of-round or taper in a worn cylinder can be corrected in less time than it takes to remove a motor for grinding on a machine.

The tool is used somewhat differently in manufacturing processes. Cylinder bores are finished or honed by mounting several tools on the spindles of multiple drilling machines, so that all the cylinders of an engine are finished at the same time. Approximately 0.0015 in. of stock is left for this honing process. With the hones rotating at 140 r.p.m. cylinder bores 2⅛ in. in diameter and 9 in. long can be honed in a few minutes, it is claimed. The bores thus honed are said to present a mirror-like finish and to be round and straight to within 0.001 in.

Hartness Comparator for Gaging Gears and Large Threads

The Hartness comparator for gaging gears, described on page 790, Vol. 56 of *American Machinist*, and made by the Jones & Lamson Machine Co., Springfield, Vt., has been slightly modified for the inspection of gears and other irregular profiles. The usefulness has been increased over the former model, as the machine will accommodate both small and large diameter threads and gears up to 20 in. in diameter. Also, the means of control has been made more convenient. The work table is 18 x 7 in. in size and can be swung 45 deg. either side of its central position.

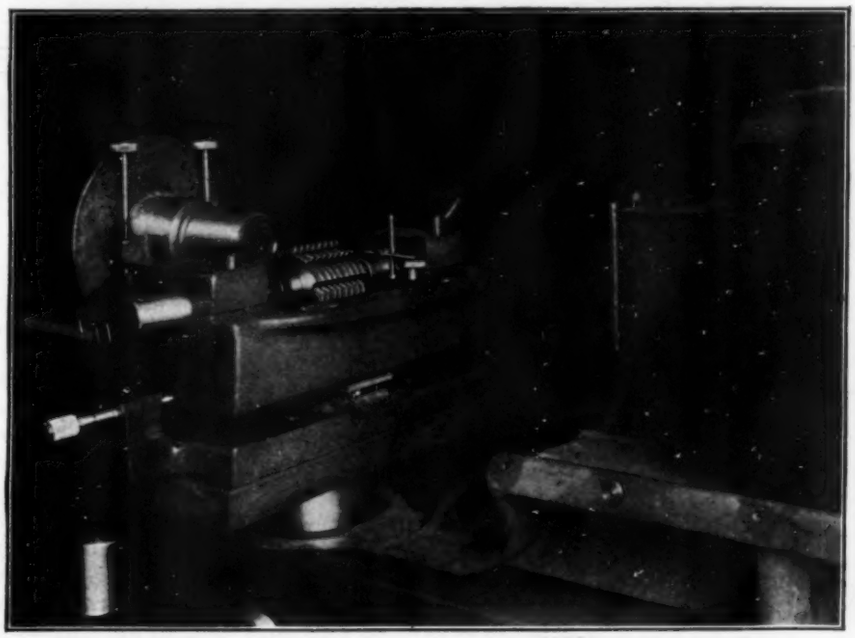
The recently developed comparator is similar in operation to the original type, but the kind of work it can do has been enlarged by the use of a different fixture for mounting the work. With a low-powered lens, the shadow is projected onto a 20 x 24-in. mirror, and reflected back to a 36 x 44-in. ground-glass screen at the side of the machine. Thus the operator can manipulate the work and also have the advantage of a large shadow at a convenient distance from his eye.

The fixture as shown in the illustration is used to mount centered work, such as taps, gages or hobs. A tooth is projected into a true outline on the screen and any error in form can then be readily detected. The micrometer on the carriage, which is mounted on three balls set in V-shaped grooves, is kept in contact with the micrometer anvil in the base by means of the suspended weight shown.

An error in lead can be detected on the screen by inserting a size block for the required value of the lead between the anvils of the micrometer. A tooth spaced equal to the thickness of the size block will fall into the outline on the screen. If the lead is long or short, the shadow will be displaced from the outline a distance equal to the error. Screws for production work are inspected on the machine in the same manner as on the original Hartness screw thread comparator. The screws are mounted in cradles and the thread projected two hundred times enlarged onto a tolerance chart 5 ft. from the operator.

The entire light source and lens system are in a self-contained unit. This unit can be moved vertically by a rack and pinion on a column 5 in. in diameter. The light source is an incandescent lamp or carbon arc.

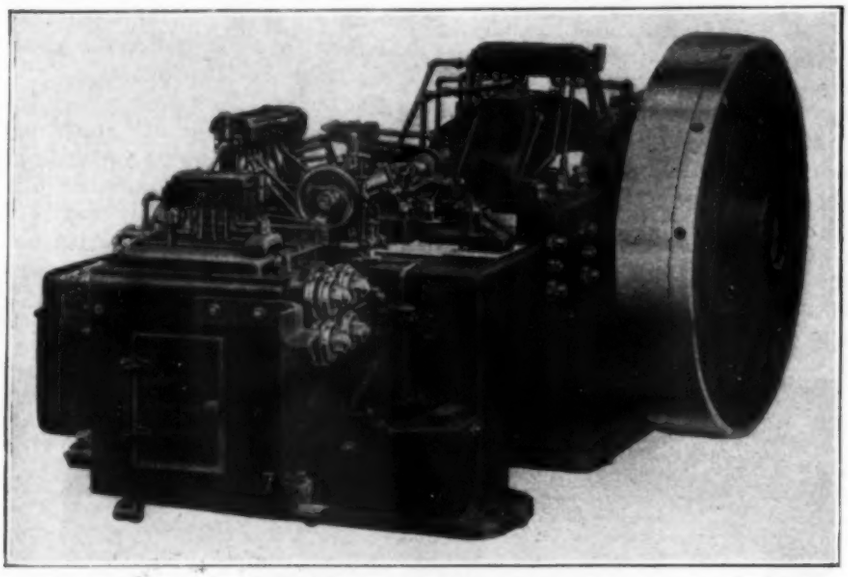
The lenses used are of a special type and are designed to free the images of sensible distortion, at the same time preserving sharp definition with a minimum of outstanding color. They are supplied in three powers of 38, 82 and 123 mm. The highest power lens, 38 mm., will project an area 1¼ in. in diameter, the 82 mm. lens ¾ in. in diameter, and the lowest power, or 123 mm. lens, work up to 1½ in. in diameter.



HARTNESS COMPARATOR ARRANGED FOR GAGING LARGE WORK

"National" 1-Inch Semi-Hot Automatic-Feed Bolt and Rivet Heading Machine

The illustration shows an automatic-feed bolt and rivet heading machine recently developed by the National Machinery Co., Tiffin, Ohio. The machine has been designed so as to increase the strength of the bed frame over that of the former model to correct defects in the gripping mechanism; to prevent premature wear and breaking down due to small size of working parts; to eliminate wasted time in the alignment of the grip dies with the heading tool; and to provide a means for adjusting the gripping or holding time of the machine.



"NATIONAL" 1-IN. SEMI-HOT AUTOMATIC-FEED BOLT AND RIVET HEADING MACHINE

The steel bed frame is only half as long as in previous designs, as with equal cross sections, the amount of "spring" in a frame is proportional to its length. The sections are also increased in size. Some idea of the strength and stiffness may be had from the fact that while the machine weighs 31,500 lb., it is only 51¾ in. from the center of the main shaft to the faceplate, and the main shaft at the crank is 11½ in. in diameter.

In previous designs, the amount of side pressure thrown upon the gripping dies depended entirely upon the extent to which the operator would introduce shimming or packing directly back of the dies. To prevent over-packing, a different design of automatic relief mechanism has been adopted. While providing all of the gripping pressure needed, the device limits the ultimate pressure obtainable, so that the upsetting of the faces of the grip dies, and their premature deterioration from this cause, is eliminated.

The hard service, and consequent wear, on the automatic-feed header was met in the following manner: By increasing the size of all the bearings and working surfaces, and adopting such features as the "suspended type" heading and gripping slides; by increasing the size and locating all of the gripping toggles horizontally, to insure proper lubrication; by limiting the ultimate pressure that can be thrown upon the toggles and gripping mechanism; and by providing a fully automatic oiling system, which oils every bearing of the machine every ten minutes. The effectiveness of these features of design is stated to be proved by the fact that after a three-year test period by the manufacturing concern, no machines have required any repairs; no re-aligning was necessary, and no working parts show wear. The record is interesting, considering the fact that automatic-feed heading machines are usually assumed to require a complete overhauling every six to nine months.

The previous trouble in die setting was overcome by mounting the heading tool in a bolster plate on the front of the heading slide. Being screw-controlled in all directions, it enables a quick and accurate adjustment of the heading tool with the gripping dies. Three lengths of bolster plates are provided, so that on long, medium or short work, the heading tool is always rigidly supported, and does not overhang.

The inflexibility of the gripping time in the old machines is corrected by providing an adjustment in the gripping toggles. Consequently, on work requiring a short gather or hold, such as rivets, it is possible to reduce the holding time to the exact requirement; but on work requiring a large amount of gather, such gather is obtainable. The result of limiting the contact with the heated stock is a reduction in heating effect on the dies, and a corresponding increase of the life of the die. The breast plate, shear and gripping dies are all water-jacketed.

One of the difficulties of the old type of machine was in the shearing mechanism, which tended to distort the end of the sheared bar, making it difficult to center the next head. The condition was corrected by building the feed mechanism at an angle to the machine proper. An angling shear is obtained, which, by compensating for the distortion, results in central heads, and makes it possible to upset and fill out an increased length of stock for large or special heads. To assist in the "control" of the stock, a bender or straightening device is regularly supplied, which, being adjustable without stopping the machine, gives complete control over the centering of the stock or the flash.

To secure alignment, suspended heading and gripping slides of unusual length are used. To avoid a long bed, the slide is extended up and over the crankshaft, having two separate sets of bearings, with the main shaft between. The slide, being provided with screw adjustments for side alignment, and the heading tool being rigidly held in the bolster plate, enables large size heads to be made with a minimum of buckling.

Not only is the straightening device adjustable without stopping the machine, but the stock gage is correspondingly arranged, with a screw of such pitch that one full turn of the handwheel gives ¼ in. adjustment of the stock. To save delay if work is accidentally caught ahead of the dies, a wedge back of the heading tool can be relieved to easily get the machine off center. An automatic tripping device is also provided on the feeding rod, so that, in case of a "sticker" in the gripping dies, the rolls are

automatically raised, thus preventing the stock from continuing to feed and piling up in the dies.

The shear and faceplate construction enables the shearing travel or "carry-over" to be adjusted. The water jacketing in the faceplate supplies cooling water to the back of the shear, but not on the cutting edge. In order to keep the water off the bar until it reaches the shear, the feed roll spindles are made hollow, and the feed rolls are water-jacketed, eliminating the necessity of running water over them and on the bar.

Attention has been given to details which would assist in maintaining high speeds. The main shaft is counterbalanced, and all unnecessary weight has been removed from reciprocating parts. An attachment is used which pushes the work from the dies rather than knocks it, and therefore the action of gravity has time to clear the work from the dies with the machine running at even higher speeds than heretofore.

The machine described is of 1-in. capacity. It is designed to simplify operations, reduce delays and assist in quick changes.

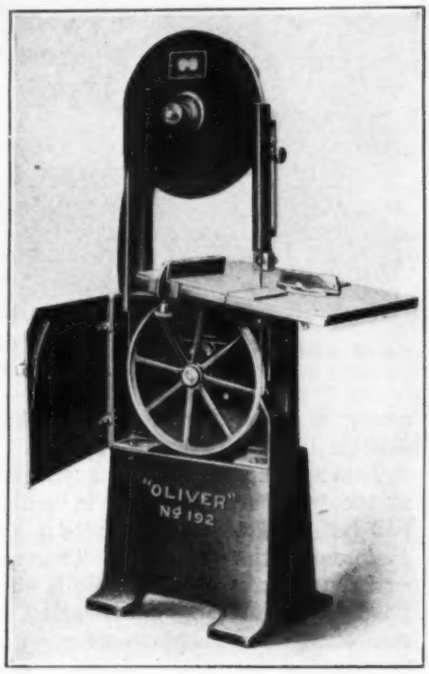
Oliver 18-Inch Portable Band Sawing Machine No. 192

The portable band sawing machine shown in illustration has recently been put on the market by the Oliver Machinery Co., Grand Rapids, Mich. This machine is designated as the 18-in. portable band sawing machine No. 192. It is intended particularly for the pattern shop and small plant, but it can be used to advantage in a large shop to save the time of the operator going to a big machine.

The wheels are 18 in. in diameter and there is full 18-in. capacity between the saw and the column. The manufacturer states that this size was chosen because after experimenting with different sizes of wheels, it was found that 18 in. is about as small as the machine can be made to be practical and to have the saw blades not crystallize. It is also claimed that with shorter blades than this machine uses, *viz.*: 9 ft. 8 in., the saws needed sharpening more often.

The machine is ball bearing throughout. It is portable and the belt-driven machine can be converted into a motor-driven machine at any time. In the latter case, the motor is fitted with cord and switch and is ready for use when attached to the ordinary lamp socket.

Features of the machine which entitle it to the name of universal are the large cast-iron table, the miter cross-cut gage and the parallel ripping fence. The grooves in the table can be filled when the cut-off gage is not in use. This machine can be put to a wide range of usage, as the table can be tipped 45 deg. Furthermore, it can use saws up to ½ in. wide and



OLIVER 18-INCH PORTABLE BAND SAWING MACHINE NO. 192

by using gages will rip up to 11 in. wide and will cross-cut and miter up to 8 inches.

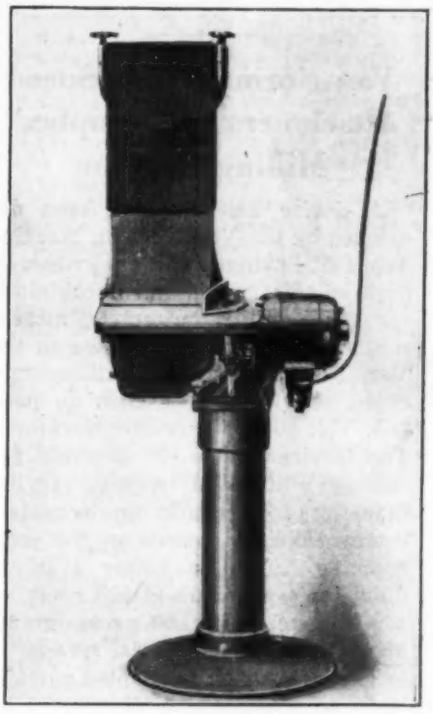
The whole unit is carefully guarded. A hinged steel door covers the lower wheel; two circular steel guards completely cover both sides of the upper wheel and they do not interfere when changing saws; a U-shaped steel guard encases the rear portion of the saw and a U-shaped cast-iron guard, adjustable with guide posts, covers all that front portion of the saw not actually doing the cutting.

The machine may be furnished without the floor base for mounting on a bench. The method of drive is through a reduction gear box with hard steel pinion and composition spur gear, all running in oil. The inclosed motor, which is a ball-bearing motor of ⅓ hp. running at 1,800 r.p.m., operates the saw at full capacity. The parts are made so as to be interchangeable between machines.

Syracuse Motor-Driven Belt Sander and Grinder

A portable direct-motor-driven belt sander and grinder for polishing and finishing parts requiring a straight grain finish and sharp edges has recently been placed on the market by the Porter-Cable Machine Co., Syracuse, N. Y. The machine, equipped with proper abrasive belts, can be used as a surfacer on metal, wood, fiber and other materials.

This Type B-1 surfacing machine, shown in the accompanying illustration, is an addition to the line of products of the former Syracuse Sander Manufacturing Co. The base, pedestal and bed of the machine are of cast iron. The 9x16-in. table is 36 in. above the floor, can be tilted 45 deg. down or 15 deg. up, and can be removed when the grinding bed is used in the horizontal position. In the latter case, it is replaced



SYRACUSE MOTOR-DRIVEN BELT SANDER AND GRINDER

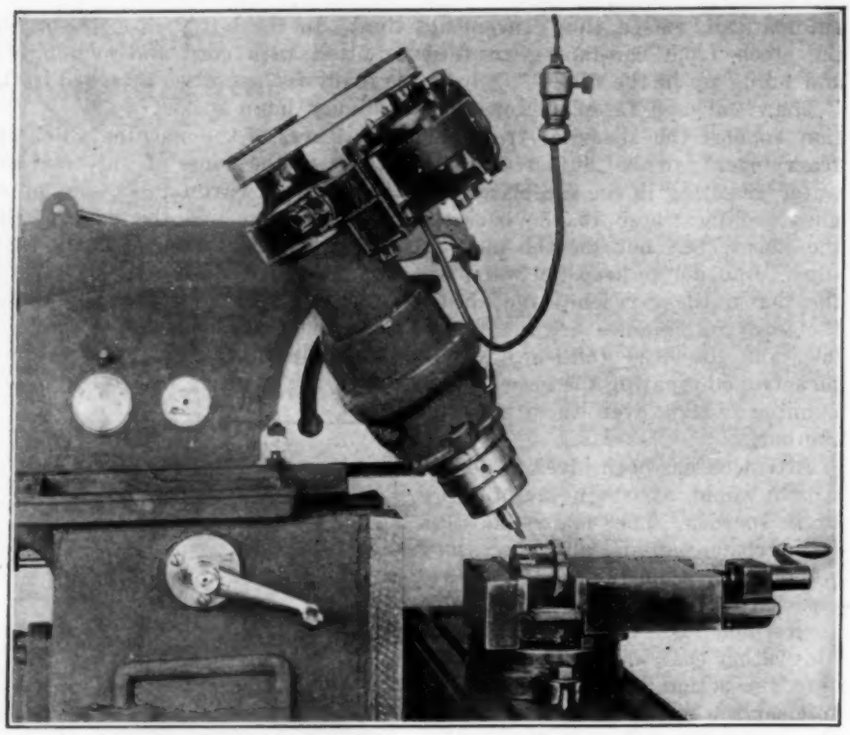
by a rod which acts as a stop when grinding or sanding small pieces. The table is equipped with angle and core-print gages, each graduated in degrees and operated in a slot that enables them to be set 45 deg. to the right or left.

A special feature of the machine is the arrangement for setting the grinding bed, which is 10½x25 in. in size, at any position from horizontal to vertical, thereby making it convenient and adaptable for different

classes of work and easy operation.

The abrasive belt, which is easily changed, is 10x64½ in. in length and runs at a constant speed on a 4-in. pulley driven at 3,600 r.p.m. Adjusting screws insure parallelism of the belt pulleys, and are also used to secure the required tension of the belt. The abrasive belts are changed to suit the type of material to be worked. Leather belts can be used for polishing and buffing.

The machine is driven directly by a ball-bearing General Electric motor having a speed of 3,600 r.p.m. Both d.c. and a.c. motors can be used, and they can be operated from either lighting or power circuits. All moving parts are provided with ball bearings and are protected by guards. A special detachable guard is provided to cover the upper part of the belt when the bed is in a vertical position. The machine has a maximum vertical height of 5 ft. 7 in., and the base is 22 in. in diameter.



VAN NORMAN HIGH-SPEED ATTACHMENT ON "DUPLEX" MILLING MACHINE

Van Norman High-Speed Attachment for "Duplex" Milling Machine

A device has recently been developed by the Van Norman Machine Tool Co., Springfield, Mass., whereby high spindle speeds can be obtained for small milling cutters by attachment of an auxiliary spindle to the Van Norman "duplex" milling machine, previously described on page 665, Vol. 50 of *American Machinist*. The device makes it possible for milling cutters of widely varying diameters to be run at approximately equal peripheral speeds on the same machine. Thus, a cutter 4 in. in diameter can be run at 125 r.p.m. or a ¼-in. cutter at 2,100 r.p.m., giving about the same peripheral speeds.

The attachment is adapted particularly to work which requires both light and heavy milling on the same piece, as the work need be clamped on the machine only once. When making metal patterns, models, dies and molds the bulk of the metal can be removed by a roughing cut, and the finish cut made at high speed.

The high-speed milling attachment, as shown in the accompanying illustration, comprises a separate ball-bearing spindle within the main cutter spindle. It is driven by a high-speed ball-bearing motor adjustably mounted on and movable with the main cutter head. The motor is attached to an ordinary electric light socket for current.

The spindle is rigidly supported at the front or cutter end in double ball bearings with provision for adjustment of the end thrust. The rear or driving end of the spindle is supported in a floating ball bearing to compensate for endwise expansion or contraction of the spindle. The front ball bearing assembly is detachably mounted on the threaded nose of the main cutter spindle, while the rear ball bearing assembly is similarly mounted on the rear of the cutter head.

The motor assembly is attached by means of a circular binder strap bored to fit a turned cylindrical surface on the rear ball bearing housing. It is, therefore, adjustable about the axis of the cutter spindle. The motor base is also pivoted on an axis parallel to the axis of the spindle, thus providing a convenient means for tightening the belt. It takes about 5 min. to set up or take down the high-speed attachment.

The high-speed spindle as regularly furnished is adapted to carry No. 5 B&S taper-shank end milling cutters. Among the advantages stressed by the maker in the use of the demountable high-speed spindle are: The cutter spindle is movable radially about a horizontal axis and can be set to cut at any angle from vertical to horizontal; the cutter head with the spindle is horizontally movable towards and away from the face of the column; the device will cut any irregular curves between a flat surface and a true circle, using a right-angle end mill; and for additional range the table has the usual vertical and cross-feed movements.

American Machinery Important Says Bank Survey

That American machinery is one of the most important industries in the world and is better known to the foreign countries than any other American product is amply proved by the statements made by the recent survey of the National City Bank, New York City. During the last ten years, the survey states, more than $4,000,000,000 worth of machinery has been shipped to various foreign ports. During the ten years preceding the last decade the export business amounted to only one billion dollars and before that the ten year period showed sales amounting to only $350,000,000.

It is pointed out that during 1921 locomotives went to thirty-seven different countries and in 1920 engines were shipped to forty-five countries. The survey at length enumerates the many machines which America makes and the world buys. Cash registers, elevators and air compressing machinery and many other products are mentioned in the report.

German Exports and Imports

German imports during 1922 amounted to approximately 6,200,000,000 gold marks, according to the Federal Statistical Office. The exports are estimated at 4,000,000,000 gold marks.

News Section

Outlook Better in the Southwest

THE FEELING among machinery dealers in the southwest in such centers as Albuquerque, N. M., and Phoenix, Ariz., is hopeful for better business in 1923. Their business may be said to depend on cattle, farming and mining, the automobile being a very important adjunct of all three and playing a vital role in the success of each. While the cowboy still rides the range on his pony, he comes to town, frequently many miles away and over streaks which are hardly roads in his trusty "tin lizzie," so that the importance of the garage and repair man is evident.

The dry season of the past year made it necessary to ship hundreds of thousands of heads of cattle to Colorado and elsewhere for grazing—and as a result, the cattle men are far from flush this year. This means that they are not buying any more of anything than necessary. The same is true of the cotton growers in Arizona. They planted on a basis of high priced cotton and the drop has left them with a margin so narrow that they are not sure on which side of the ledger the balance will be.

INFLUENCE ON MACHINERY

All these things affect machinery and eventually machine tools. Farming in this country is largely a matter of machinery. Irrigation requires pumps of large capacities. Wells have to be driven or irrigation dams built—and all this means machinery. Likewise it affects the automobile trade to a marked degree. And it is difficult to realize, without actually seeing it, what a large proportion of the business of such a city as Phoenix, Ariz., depends upon the automobile. Agencies for cars and for accessories are numerous. But what is more impressive is the number of welding shops, shops for motor repairs, filling stations, and last but hardly least, a huge wrecking plant which is a veritable graveyard of motor cars. Perhaps a dissecting room would be a better simile, for the cars are dismantled, the usable parts stored in classified racks and the whole thing run on a business basis.

Here, as in most places, the facilities for repairs are not of the best except in a few shops. Several shops have cylinder grinders, grinders for piston pins and crankshafts and the refitting of new pistons seems to be quite common. One reason is that this is an "all year" country and the cars never get a rest as in the north. Some of the shops have good lathes, milling machines, grinders and drilling machines, and welding outfits are common, but there is still room for many new machine tools.

The tractor and truck make a large portion of the work for these shops. I heard of one case, however, where a Japanese farmer kept his tractor going three years without an overhaul, credit for this being given to his plan of changing the oil regularly after every ten hours run. Then, too, there are a number of cases where some of the husky old motors such as the big Olds six, the old Pope-Hartford four and others of similar vintage, are doing duty driving irrigating pumps on the outlying farms.

Mining activities are on the mend. The copper mines in the south are getting back to normal production which indicates that the large war supply has been practically absorbed. There is also more activity in the northern mines of the gold and silver districts, all of which leads the machinery dealers to look forward to a better year than 1922. And all machine activity ultimately gets back to the builder of machine tools.

Important Patent Case Decided

On Feb. 19 a decision was handed down by the United States Supreme Court which closes the way to what had promised to be endless litigation. Suit had been brought against the Crown Die & Tool Co. by the Nye Tool & Machine Works for infringement on a patent owned by the Reed Manufacturing Company, Erie, Pa., the Nye Tool & Machine Works having purchased the right to sue from the holders of the patent.

In deciding the case, the Supreme Court upheld the contention of the defendant, which was that the granting of a patent carries with it the exclusive right to manufacture, sell or use the article in question, but in no way refers to the matter of selling the right to bring suit for infringement of the patent. Furthermore, the Court stated, were the case decided in favor of the plaintiff, this would open the way for all sorts of litigation which was not within the original intention of the patent laws, and would pervert the use of such laws from the original object of protection for the patentee to a base for litigation by others than the owner of the patent. In fact since this suit was begun there have been a number of similar suits started.

Herbert Hoover Talks to Business Paper Editors

The regular monthly dinner of the National Conference of Business Paper Editors with Secretary of Commerce Herbert Hoover was held at Washington, D. C., on Feb. 19. The editors met for luncheon at the Cosmos Club and listened to remarks on the coal situation by John Hayes Hammond, chairmen of the President's Fact Finding Commission, who was the guest of the occasion. The afternoon was spent in the office of the Chamber of Commerce of the United States where various national and business problems were discussed with the officials and experts of the Chamber.

Studebaker Reports Record Year

The annual report of the Studebaker Corp. for the year 1922 shows that the net earnings after the payment of dividends upon the preferred stock amounted to $18,086,195 which is equivalent to $29.02 on the $60,000,000 common stock and $23.31 on the issue of $75,000,000 common stock.

In a statement to the stockholders, A. R. Erskine, president of the corporation stated:

"Last year's business was the largest the corporation ever enjoyed. Demand continued unabated until November, when orders for open cars decreased, and we curtailed production accordingly. However, total demand for the year exceeded capacity by thousands of cars. Actual sales of 110,269 cars topped 1921 by 65½ per cent and 1920 by 114 per cent.

"Based upon satisfactory condition of business at home and improvements that have been made and are occurring in foreign countries, and especially because of the strong commercial position of the corporation, it appears that business this year should be obtained in large volume.

"Accordingly, we are planning to produce in the first quarter 35,000 cars, compared with 26,665 last year and 10,983 the previous year in the same quarter. The management believes that business for the year as a whole will show a substantial increase over that of last year."

Mining Drills Discussed

At the Drill-Steel section of the New York meeting of the American Institute of Mining and Metallurgy, Feb. 19, in the Engineering Societies Building, several papers were read and discussed. Among them were the following: "Hardness and Heat Treatment of Mining Drill-Steel Shanks" by Charles Y. Clayton, Professor of Metallurgy, Missouri School of Mines and "Review of Present Status of Drill-Steel Breakage and Heat Treatment," by Francis B. Foley, Metallurgist, U. S. Bureau of Mines, Prof. Charles Y. Clayton and Henry S. Burnholz, Metallurgist, U. S. Bureau of Standards. Both papers contain the results of a great many experiments conducted either by, or under the direction of, the U. S. Bureaus of Mines and Standards.

The discussions brought out a great deal of practical information as to furnaces for heat treating, temperature control and quenching media.

Stereoptican views were shown of an automatic furnace for heating and quenching mine drills and of a machine for heating rods and tubes by electric current, the degree of heat being determined by the expansion of the rod or tube itself read on a scale calibrated for the purpose. The meeting was very well attended.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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Indianapolis, Ind.

I AM HERE on my way back to New York after having visited Norfolk, Va.; Augusta and Atlanta, Ga.; Montgomery, Selma, Demopolis and Birmingham, Ala.; St. Louis, St. Joseph and Fulton, Mo.; Omaha, Neb.; Des Moines and Sioux City, Iowa; and Quincy, Ill.

The many business men that I have talked with are almost unanimously and aggressively optimistic. Their attitude is illustrated by that of an Iowa newspaper reporter who told me that he had been so long under orders to take a cheerful view that he found himself almost unconsciously writing an obituary notice which read as follows: "Thomas Smith, a prominent and successful citizen, died today. He had many friends who are greatly bereaved by his death, but it will not in any way check the business revival now in progress or the improved demand for goods that is reported by our merchants."

The same spirit is expressed in the phrase "The day of the tightwad has passed" used as a scare head for a newspaper article demanding that the proceeds of a municipal bond issue recently authorized should be immediately spent for city improvements to which the Mayor had objected as extravagant. The same disposition to loosen up is expressed in liberal buying for the spring trade and the large sales reported by the traveling men, of whom there seems to be an unusually large number on the road.

The result is an activity which is daily gaining momentum and is not likely to be checked by anything short of a buyers' strike or some sensationally depressing incident, neither of which is now in sight.

Fundamentally, the recovery is a natural reaction from the depression of the last two years. It has been brought about by the drastic liquidation which has released credit and made it possible for bankers to sell nearly two billions of new securities since the first of the year. It is, however, a mistake to assume that these securities have been absorbed by individual investors. The bond selling organizations of the country have now been extended so that they include as underwriters many of the smaller country banks and not a few of these institutions have been induced to withdraw the securities allotted them as an investment for what is called their secondary reserve upon the theory that the bonds can be sold when the money is needed. It remains to be seen whether this theory will work out. Some of the more conservative bankers doubt it and express more or less apprehension in regard to the situation thus created.

Upon the whole, however, there is but little disposition to borrow trouble of the future. Labor is fully employed, prices are rising, stocks of merchandise are still below normal and, if the crops turn out well, it seems reasonable to expect a prosperous spring and summer.

In and around Indianapolis, which claims to be the largest hog market in the country, and the center of our greatest hog producing territory, the feeling is especially optimistic upon the theory that with hogs at present prices the corn fed to them is sold at 85 cents a bushel which yields the farmer a very handsome profit.

"The activity of business is indeed remarkable. Figures of the Department of Commerce for January show a large increase in productive activity and the output of practically all basic commodities is the largest since the boom period of 1920. In some cases it even exceeds those records. Car loadings are much larger than they have ever been before at this time of the year. The steel mills are working as near capacity as they ever get."

The merchant who told me this added that if wheat could be marketed at a dollar and a half, the Hoosier for once in his life would be perfectly happy.

But as one comes East there is to be noticed an increased interest in the Franco-German impasse and a recognition of the sinister effect it will have upon our export trade unless a way out of it is soon found. This and the wide publicity given to the statement that brokers' loans in New York now approximate two billion dollars as compared with half a billion two years ago are making an impression upon the minds of the trained students of financial conditions, of whom so many are now to be found in the larger cities of the Middle West, and it may be that the buoyancy of the stock markets will prove to be less enduring than that of the distributive trade in merchandise.

This would be natural and perhaps salutary for a concurrent boom in stocks and commodities would be likely to overtax even the abundant credit facilities with which the country is now provided.

Although it has attracted but little attention, the announcement that the Federal Reserve Bank of New York has advanced its rediscount rate to 4½ per cent, should not be ignored. As the reserve ratio still indicates a surplus if not a plethora of lendable credit it is to be inferred that the Federal Reserve officers have detected some evidence of over expansion which has led them to sound a cautionary note.

It may be that they feel that the increase in brokers' loans or the continued purchase of bonds by the banks ought to be checked but whatever the facts behind it there is no doubt that the advance in the rate will give power to the bear speculators in the stock market.

The activity of business is indeed remarkable. Figures of the Department of Commerce for January show a large increase in productive activity and the output of virtually all basic commodities is the largest since the boom period of 1920. In some cases it even exceeds those records. Car loadings are much larger than they have ever been before at this time of the year. The steel mills are working as near capacity as they ever get. The automobile industry is still breaking records. The trend of prices is still distinctly upward under the leadership of sugar, coffee, petroleum and the other commodities which have featured recent market news. Lumber and building materials are higher, but the excited cheerfulness of the building trade has been somewhat tempered by the widespread reports of a shortage of labor. It is said that the construction industry alone will demand this spring about 300,000 more laborers than will be available. We have already heard similar reports from other industries and though the effects of the shortage will not be felt at first because of its tendency to raise prices and wages, its ultimate dangers are obvious unless it can be overcome by more efficient work. It is a sample of the lurking dangers with which the boom eventually will be confronted.

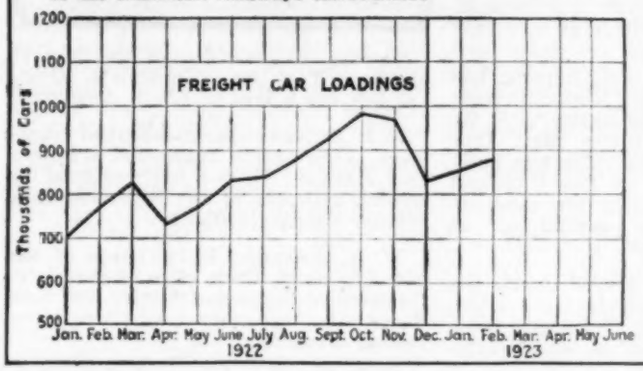
In so far as statistics are available our import trade thus far has not been greatly affected by the tariff. The trade and industry of Great Britain are improving and sterling exchange has resumed its advance toward par.

That Great Britain is keeping step with us in our progress goes far to offset some of the more discouraging items from the Ruhr and other parts of the world. But despite the general rosiness of the outlook, it seems to me that it is desirable to take at least a small supply of caution along with the generous amount of confident optimism which we all possess.

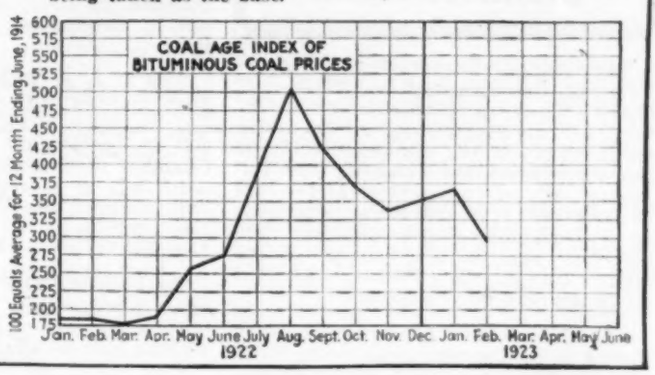
Inland Steel Plans Big Expansion

The plant capacity of the Inland Steel Co. will be increased twenty-five per cent, according to recent reports from Chicago that state that the Company has abandoned all thought of combining with any other steel company and is preparing to enlarge its plant. It is rumored that an issue of preferred stock will be marketed through Kuhn, Loeb & Co. and that with the proceeds the expansion campaign will be started. This company has never had a preferred stock.

Weekly car loadings of revenue freight based on reports from the railroads of the U. S. by the Car Service Division of the American Railways Association.



Coal Age Index of Bituminous Coal Prices, f.o.b. mines, the average of spot prices from July, 1913, to June, 1914, being taken as the base.



FREIGHT CAR LOADING increased perceptibly during January and according to the reports issued by the American Car Association, there were 865,675 cars loaded during the month. From every part of the country comes the cry for freight cars and some cities, like Detroit and Buffalo, have experienced trouble in getting sufficient cars to take care of the ever increasing business which these centers are enjoying. In addition to the prosperity which all industry is undergoing, the carriers must also take care of the loads which accumulated during the strikes of last fall and early winter. Predictions are that more freight cars will be used during February and March than ever before in the history of railroads. All roads are making earnest effort to get in shape as many cars as possible for the expected business.

Automobile Production during the month of January broke another record and following the year's record made in 1922 the question of whether it can keep up is permissible. From every indication, it would seem that there is but little limit to the demand and reports state that export automotive business has increased and there is every reason to believe that it will further increase as the year progresses. During January, the production figures show that there were manufactured 243,000 automobiles of all kinds. From Detroit, the center of the industry come reports that workers are in demand and that section of the country is undergoing an area of prosperity that has seldom been the good fortune of any one part of the United States.

Comparative Prices of Shop Supplies

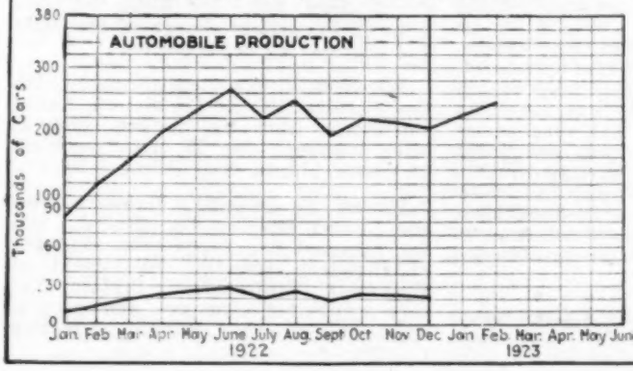
Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0303	$0.030	$0.0247
Cold finished shafting	per lb	0.0397	0.0385	0.0336
Brass rods	per lb	0.1804	0.1742	0.1516
Solder (½ and ½)	per lb	0.2617	0.2425	0.2075
Cotton waste	per lb.	0.1181	0.1175	0.106
Washers, cast iron (½ in.)	per 100 lb.	4.33	4.33	3.83
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	2.96	2.96	3.11
Lard cutting oil	per gal.	0.5575	0.5583	0.57
Machine oil	per gal.	0.349	0.36	0.40
Belting, leather, medium	off list	49%	49%	46⅔%
Machine bolts up to 1 x 30 in.	off list	51⅓%	51⅓%	64⅔%

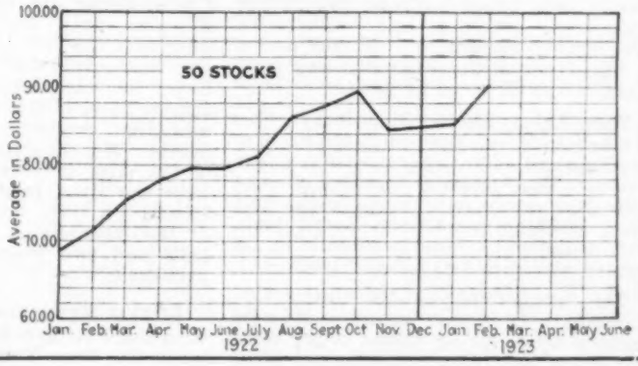
Coal Age Index of Bituminous Coal Prices this month is placed at 296 which is much lower than it has been for some time past and which is taken as a good indication by manufacturers located throughout the United States, who are the real consumers of coal in quantities. Bituminous prices have taken a slight drop during the past week and when the warmer weather of the spring sets in there is every reason to believe that coal will not only be plentiful but cheaper than it is at the present time, barring trouble at the mines, freight congestions and other unforeseen ills which have caused difficulties in the past.

Fifty stocks which are shown in the chart below average this month 90.30 which is a big jump as compared to the average in the two preceding months and is above the average shown in November which was a high point. The cause of most of this increase is due to the annual statements which have been made by various companies. Nearly every statement that has been issued by corporations of an industrial nature shows an increase as compared with the 1921 statement. More confidence has been shown by the investors and speculators for common shares than for some time past. Since the first of the year there has been 11,426,400 more shares sold on the exchange than during a like period in 1922.

Passenger cars and trucks, production based on figures compiled by the Bureau of Foreign and Domestic Commerce. Average for 1919, 138,138 cars; 26,364 trucks.



New York Times Annalist combined average price of 25 railroad and 25 industrial stocks based on weekly averages of last sale in each week.



Business Items

The Paquin Corporation, Windsor, Vermont, has reopened the "Mill End Cutlery Shop," a substantial brick factory, for the manufacture of hardware specialties. At the annual meeting of the corporation held recently the following officers were elected for the ensuing year: Frank Hale, president; G. W. Durkee, treasurer and clerk. The directors are E. F. Paquin, Frank Hale, Daniel H. Parker, Edward Anderson and Guy Hubbard.

The Mine & Smelter Supply Co., with branches in Denver, Salt Lake City, and El Paso, has taken over the distribution of Wilson Plastic Arc Welders and Wilson Welding Metals.

The American Metal Products Co., Milwaukee, Wis., reports an increase of 400 per cent in business as compared with 1921. The company has installed a Detroit electric rocking type furnace.

The government-owned land, buildings, improvements and equipment located at the Erie Howitzer Plant, Erie, Pa., will be offered for sale, by auction, at 2. p.m. Friday, March 9. The sale will be conducted by the quartermaster general of the army.

Announcement is made of the organization of the Flint Structural Steel Co., Flint, Mich. The company is affiliated with the Massillon Bridge Co., Massillon, Ohio, that recently purchased the Flint plant of the Perkins Structural Steel Co. and in turn sold it to the Flint Structural Steel Co. Officers of the latter company are: President, E. Rice; vice-president and general manager, R. W. Heerlein, and secretary and treasurer, Charles D. Yost.

At a recent meeting of the directors of the Homer Engineering Co., Canton, Ohio, the following officers were elected: F. E. Homer, president; W. A. Bushong, vice-president; F. A. Carlisle, secretary and treasurer.

The Eastern Machine Screw Co., screw machine products, New Haven, Conn., has increased its capital stock from $500,000 to $600,000.

The Portable Cable Machine Co., has succeeded to the Syracuse Sander Manufacturing Co., Syracuse, N. Y.

The M-B Automotive Corp., Nashville, Tenn., has leased a number of industrial buildings and equipment from the Nashville Industrial Corp. and will manufacture a complete line of trucks, auto buses, railroad automotive equipment, tractors and automotive fire-fighting apparatus. M. Bollstrum is president of the company and Guy Hamilton is director of sales.

The Lake Shore Machinery Co., Muskegon, Mich., has completed its new building and will occupy it within a few weeks. The company handles a complete line of machine tools, metal and wood working machinery, small tools and equipment. The new building is located at 810 and 812 Peck Street.

The Ideal Concrete Machinery Co., Cincinnati, Ohio, has moved to its new factory 5000 Spring Grove Ave., Winton Place, suburb of Cincinnati, Ohio.

According to unconfirmed rumors in the northwest, the Northern Pacific railway intends to construct a $2,000,000 railroad in southeastern Montana to aid in developing coal mines in the Rosebud District.

The S. & S. Body Co., Detroit, has been merged with the National Body Co., Bay City, Mich., according to E. W. Atkins, president of the Bay City Chamber of Commerce. The new company will be located at Bay City and will manufacture bodies for commercial trucks. It is capitalized at $100,000.

By order of the Federal Court, the seven plants of the Standard Parts Co., with headquarters in Cleveland, Ohio, will be sold at auction by the receiver.

There has been a dissolution of partnership between Henry Dreses and William Gilbert, owners of the Dreses Machine Tool Co., Cincinnati, Ohio. Mr. Dreses who has been actively engaged in business for many years will retire and Mr. Gilbert has formed an organization which will be capitalized for a quarter of a million dollars and which will continue the business of the company.

The Hydraulic Press Manufacturing Co., Mt. Gilead, Ohio, has increased its capital stock from $260,000 to $1,200,000. A new issue of seven per cent preferred stock will be on the market soon to cover $180,000 of the increase while the rest has already been subscribed.

The Syracuse Supply Co., Syracuse, N. Y., has been appointed exclusive agent by the Foster Machine Co., Elkhart, Ind., for its line of screw machines, turret lathes and tools.

The Gibb Instrument Co., Bay City, Mich., electric welding equipment, has increased its authorized capital stock from $75,000 to $175,000. Of the increase, $40,000 has been sold at par to provide increased manufacturing facilities and to take care of a rapidly increasing business.

The National Industrial Advertisers' Association has recently been accepted as a department of the Associated Advertising Clubs of the World.

Obituary

ALEXIS W. THOMPSON, aged 73 years, former president of the Republic Iron and Steel Co., died recently in Battle Creek, Mich. He was president of the Republic until April, 1906, when he went with the Inland Steel Co., Chicago, and was eventually elected president. Later he was named chairman of the Inland Steel board. He was connected with that company at the time of his death. Mr. Thompson was prominent in the steel industry, starting in 1875 with the Etna Iron Works, Ltd., New Castle, Pa. He became vice-president of the Republic at its organization in 1899 and two years later was named president.

JOSEPH REYNOLDS, for sixteen years with the Newman-Andrew Co., 26 Cortlandt St., New York, died Feb. 3.

Personals

SAMUEL BLACKBURN, of the Morris Machine Tool Co., Cincinnati, Ohio, has left for a trip to South America.

A. P. MCNAB superintendent of tramways, Nova Scotia Tramways & Power Co., Halifax, N. S., has resigned to become manager of the Riverside Iron Works, Calgary, Alberta.

W. A. AMELUNG is in charge of the new Cleveland, Ohio, office of the U. T. Hungerford Brass and Copper Co., New York. The new office is situated in the Leader Building.

C. P. KLEIN has been elected president of the Klein Iron Works, Bellvue, Ohio. W. L. Willing has been named vice-president and A. C. Lingling, secretary and treasurer of the company.

M. G. DUMAS of Indiana Harbor, Ind., has accepted a position as metallurgist with the Alloy Electric Castings Co., Youngstown, Ohio.

E. M. HERR, president of the Westinghouse Electric & Manufacturing Co. on Feb. 8 addressed the executives, editors and business managers of the McGraw-Hill Company, Inc., in the company's building at Tenth Ave. and 36th St., New York City. Mr. Herr outlined the possibilities of development in the electrical industry and indicated how production costs can be decreased. MERRYLE STANLEY TRITLE, in charge of the Westinghouse merchandising division also spoke, explaining the importance of the household class of electric goods.

CLARENCE T. KAUFMAN, foreman of the machine shop of the Seiberling Rubber Co., Barberton, Ohio, is now located in Wooster, Ohio, where he is serving as master mechanic of the Racer Disc Wheel and Rubber Co. of that city.

T. E. BARTON, master mechanic with the Delaware, Lackawana & Western Railroad, has been appointed treasurer of the American Welding Society to fill the unexpired term caused by the resignation of Mr. Symons, who has been treasurer since the inception of the society.

HENRY A. KLEIN has resigned from the Durant Motors Co. and will have charge of the standardization of design for the Eadie Trailer Corp., New York.

OSKAR KYLIN was recently elected vice-president of the Foster Machine Co., Elkhart, Ind. Mr. Kylin will continue in immediate charge of the sales and engineering departments.

WILLIAM W. SCHWEBS, formerly with the Western Electric Co. and the Keller Pneumatic Tool Co. is now general sales manager for W. L. Procunier, 14 South Clinton St., Chicago, Ill.

HENRY F. RUSSELL, formerly with the Lumen Bearing Co., Buffalo, and for the past five years sales manager of the iron foundry department of Farrar & Trefts, Inc., Buffalo, has been appointed treasurer and general manager of the Buffalo Smelting Co., Inc.

Notes from Foreign Countries

One of the members of the Turkish Delegation at the Lausanne Conference told your correspondent that the Angora Government was about to ask bids for 80 locomotives of different types. American locomotive builders should not fail to correspond with the Minister of Public Works at Angora (Asia Minor).

The Rumanian Government has just placed an order for 100 passenger railway cars with German manufacturers at the total price of 80 million gold marks.

According to a report from Strassburg, the Alsacian machinery industry is seriously suffering from lack of orders. The high tariffs of the Alsacian railroads are chiefly responsible for this situation, as those of the French ralways are much lower and moreover the Alsacian works have to bring far greater sacrifices for social purposes than their French competitors. During the year 1922, quite a number of new plants have been put in operation for the manufacture of electrotechnical apparatus and machines, as a result of the increasing use of electric energy in the country.

German Textile Machines

While up to some time ago American made textile machines were exported to a large extent to British India it now seems that German machines are leading. According to a report of the British commercial delegate in India just published in London the imports of textile machines from Germany during the first half year of 1922 increased by 30 per cent as against the imports during the same period of the previous year, representing a value of no less than about 1,950,000 dollars. Largely increasing are also the imports of Swiss textile machines, from $150,000 worth in the first half year of 1921 to $450,000 worth during the first six months of 1922. England, too, lost considerably in the imports of textile machines into India.

Vickers Limited of England has just acquired 30 per cent of the stock-capital of the Reschitza Company in Rumania, one of the largest steelworks of former Austria-Hungary, now situated in Rumania. Already a few months ago the Vickers, Ltd., had bought 25 per cent of the shares of this company. The capital of the company has at the same time been increased to 175 million Lei. The works are engaged in the manufacture of all kinds of railroad material, including steel rails, locomotives and cars.

French Iron Imports Increase

French imports of pig iron, rolled iron and steel amounted during the first ten months of 1922 to 681,417 tons valued at 443.8 million francs as against 413,706 tons valued at 405.5 million francs during the same period of the previous year. The exports of the same class of goods amounted to 2,340,608 tons valued at 814.1 million francs against 1,725,461 tons valued at 641 million francs during the first ten months of 1921.

According to figures published by the Soviet authorities at Moscow, the Russian railways are suffering from lack of fuel. The coal production of the entire country amounts to about four per cent of that before the war.

Budapest papers announce the arrangement agreed upon between the official commercial agency of the Soviet Republic and leading Hungarian manufacturers of agricultural machines and implements for the exportation of these goods to Russia. The report adds that the demand for all kinds of agricultural machines and implements in Russia is tremendous. The new Russia State Bank will guarantee the payments of all shipments.

Record Street Railway Order Placed

An order amounting to more than a million and a half dollars has been received by the General Electric Co., Schenectady, N. Y., from the Philadelphia Rapid Transit Co. for car equipment for 520 new cars that are to be placed in service on its lines. The order consists of 1,040 GE-275-A railway motors, two motors for each car. Also control equipment and air compressors for each car have been ordered. This is a record order to be placed by any street car company. The cars are to be built by the J. G. Brill Co.

Statement of American Locomotive Company

The annual report of the American Locomotive Co. shows that during 1922 it earned $29,122,112 which is a decrease from the gross earnings of 1921 when the report showed a total for the year of $35,711,508. The decrease is explained by the fact that there were few orders during the first part of 1922. In contrast with last January, the American Locomotive Co. has on its books in unfilled orders, $49,349,140 whereas on Jan. 1, 1922 there were on the books orders amounting to only $3,344,300.

U. S. Steel Spends Millions In Welfare Work

Since 1906, the United States Steel Corporation has spent $108,509,723 for welfare work according to the recent report of Charles L. Close in charge of safety, sanitation and welfare work in the various departments of the corporation. The report, which covers the period up to Dec. 31, 1922, further shows that the percentage of decrease in the accident rate amounts to 56.13 per thousand workers and estimates that 2,971 employees were saved from serious accidents during the time that the welfare work has been in effect.

Hold Group Meeting in Detroit

The Electric Steel Founders' Research Group held one of its regular meetings in Detroit, Feb. 5 and 6. The group is composed of the following companies: Electric Steel Co., Chicago, Fort Pitt Steel Casting Co., Lebanon Steel Foundry, Michigan Steel Casting Co., and the Sivyer Steel Casting Co. Discussions and reports were brought up during the meeting regarding electric furnace practice, core practice and facing practice.

The meeting was well attended and much interest was shown by those present. It was the general opinion that group discussions were of much value.

News of Washington Activities

By Paul Wooton

As the result of a preliminary conference with officials of the Division of Simplified Practices of the Department of Commerce, manufacturers of steel lockers have appointed a committee to survey the industry and report at a subsequent meeting on the practicability of eliminating some of the sizes which now are supplied.

It was stated at the conference that more than 100 sizes of lockers are being manufactured and the representatives present agreed that this number is considerably in excess of real needs. Style of lock, ventilation and other features have more influence upon sales than minor variations in sizes, it was stated.

The committee on survey will not only canvass the situation among manufacturers and distributors but will take up the subject with architects and others who control specifications. C. S. Berger of the Berger Manufacturing Co. was chosen chairman of the survey committee, and appointed as associate members M. C. Miller of the Fred Medart Manufacturing Co., M. S. Hart of the Hart & Hutchinson Co. and W. G. Brown of the Durant Steel Locker Co. Other representatives who attended the conference were S. D. Leland of the Manufacturing Equipment & Manufacturing Company, Arthur McGrew of the Durabilt Steel Locker Company, J. B. O'Connor of the Lyon Metallic Manufacturing Company, Graham H. Piggot of the Federal Steel Fixture Company, Ralph K. Safford of the Atlas Manufacturing Company and A. J. Thornley of the Narragansett Machine Company.

A Commission on Unemployment

The Senate committee on education and labor has reported favorably and without amendment the Frelinghuysen bill to create a Commission on Unemployment to study public works which may be undertaken advantageously in periods of depression when abnormal numbers of men are without work.

If enacted, the bill would establish a commission of three members to be named by the President and to serve without compensation excepting reimbursement for expenses incurred in performing their duties, but with authority to employ engineers, draftsmen and other assistants. It would appropriate $100,000 for expenses of the commission until June 30, 1924.

American Electric Fusion Corporation Expands

The American Electric Fusion Corp. has purchased a site for its new factory in the 2,600 block on Diversey Boulevard, Chicago.

A program of expansion that will be carried through in 1923, plans for a total floor space of between 80,000 to 100,000 sq.ft. of floor.

The first unit, a two-story building of 20,000 sq.ft. is being erected now.

The company reports as exceedingly busy during the second half of 1922, and the present orders on hand are sufficient to keep it going for at least the next 3 or 4 months. E. J. Henke is the president of the corporation and Gus F. Strand the treasurer. The additional space provided by the new building will enable the corporation to greatly improve its deliveries.

Increased Demand for American Machinery In All Parts of Europe

FROM all parts of the Balkan Peninsula comes the news announcing the industrial regeneration of the various countries of that part of Europe, and American machinery manufacturers would do well by paying close attention to those markets.

Though at the present time the principal imports of machinery and tools still come from countries with bad currency, yet the demand for "quality machines" is increasing and quite a number of managers and engineers are well aware of the superiority of American made machines and quite particularly of the superiority of American machine tools. It should be added that in most of the leading industries of the Balkan countries there are employed many superintendents and foremen who have worked several years in the United States and, therefore, are well acquainted with American methods as well as with American quality tools. It should, however, be borne in mind that catalogs in the English language are of little use in those countries. They may be all right for those engineers who had an American training, but the orders are chiefly being placed by the machinery importers located in such places as Bucarest, Warna, Constanza, Braila, Galatz, Sofia, Rutschuk, Belgrade, Athens, Patras, Pyraeus, etc. Catalogs and printed matter in German or French would do best.

Hungarian Success

At the present time the Hungarian machinery industry is leading in the Balkan markets. After the end of the war Hungarian manufacturers soon opened close commercial relations with Bulgaria which were facilitated by the low rate of exchange in both countries, and in spite of all political differences with Yougoslavia, Hungary does a large business with that State, the more as the Yougoslavian State Railways have placed considerable orders for locomotive and car repairs with Hungarian manufacturers. At present Hungarian machinery manufacturers are also negotiating with the Roumanian Government and Bucarest importers and machinery merchants for the supply of all kinds of machinery and tools.

Where Machines and Tools Are Wanted

A friend of the writer, who has been in the Balkan machinery business for the last twenty-five years, states that the following machines are finding a ready sale:

Roumania: Machine tools, railway tools, flour-mill machinery, saw-mill and wood-working machines, all kinds of machines used in the petroleum industries including pumps and electrical machines, spinning and weaving machines as well as general mill supplies.

Bulgaria: Machine tools, railway material, electrical appliances, tools used in tanneries and leather industries, and especially saw-mill machines. The lumber industry of Bulgaria is assuming large proportions and a good deal of foreign capital has recently been invested in that branch of industry.

Yougoslavia: Machine tools, railway tools, electric machines, wood-working machines, and especially small tools for carpenters, blacksmiths, carriage builders, and similar trades.

Greece: Machinery and tools used in shipbuilding, general machine tools, railway tools, flour mill machinery, soap making machines, electrical tools, etc.

Agricultural machines and implements of every description are in good demand in all of the above countries.

Skoda Works Is Sold

The Skoda Works of Pilsen in Bohemia has attracted much attention of late. First it was reported that Hugo Stinnes had taken a great financial interest in this plant, but soon afterward this news was denied. As a matter of fact, the French Schneider-Creusot Works has taken a large interest in this Checoslowakian enterprise. Like the Krupps at Essen, the Skoda works at Pilsen has undergone a rapid development. Founded in 1869 by Emil Skoda, a mechanical engineer of repute, the plant was put in operation with 150 men. At the present time, the combined works at Pilsen, Doudlevec, Nyrany, Smichow and Hradec-Kralové, a concentration of the Skoda Works and those of the Ruston, Bromovsky & Ringhoffer Works of Prague, now all united into the firm of Skoda Works Limited, with general offices at Prague, and capitalized at 200,000,000 Checoslowakian crowns (at the present rate of exchange about $6,500,000) represent today with Schneider Creusot of France one of the largest metallurgical concerns of the world.

The Pilsen plant alone covers an area of 555 hectares consuming 43,500 HP, is equipped with about 7,000 machines of almost every description, among which are many American machine tools, including turning lathes capable of handling working pieces up to 14 meters, travelling-cranes lifting up to 120,000 kilograms, forge presses of a capacity of 500,000 kilograms and a Harmet press of 1,000,000 kilograms of pressure.

The production at the Pilsen plant of the gigantic machine parts for the famous ocean steamers "La France," "Titanic" and "Deutschland," the powerful dredgers for the Suez Canal, the huge machine parts for the turbines of Niagara Falls as well as of the floating cranes at Pola with a capacity of 240,000 kilograms best illustrate the high efficiency of the works. The output of the Skoda plants at Pilsen amounts to no less than 31,600 car loads per annum, and forged parts weighing from 80,000 to 110,000 kilograms are frequently turned out.

Various Products

The present Works includes steel works, iron and metal foundries, press works, extensive blacksmith's shops, factories for the manufacture of railroad wheel tires, springs of all kinds, fittings, cog-wheels, screws and rivets, locomotive works, automobile works, gun factories, ammunition works, a shipbuilding plant, machine shops, electrotechnical works, crane and bridge building plant, structural iron works, saw-mills, woodworking and pattern shops, a coal mine and several lime kilns. About 25,000 men are now employed in the works.

Conditions prevailing at present in the Austrian machinery industries are very gloomy. Nearly all plants work at largely reduced time, in many cases up to 70 per cent of normal hours, and numerous discharges of workmen are the order of the day. In fact, the machinery branch supplies the principal contingent of the army of unemployed. The chief reason for this state of affairs is the rate of exchange. The fall of the German mark, as well as the sudden decrease in the net cost of the Chechian production together with sudden amelioration or better stability of the Austrian crown are responsible for these conditions. The Austrian wages which, in spite of the index system, had not followed the rapid destruction of the currency have now almost reached the peace level. At present the wages per working hour average between 7,000 and 9,000 crowns.

A similar evolution has taken place in raw material prices which are at present higher in Austria than in high currency countries, so that Austrian manufacturers are buying frequently their raw material in Checho-Slowakia and in western countries.

To make matters worse, most of the Austrian machinery merchants have large stocks on hand, chiefly of foreign origin, which they are now offering at largely reduced prices.

Especially unfavorable are the conditions for the small provincial manufacturers. Shops which up to the month of October last still employed 100 and more hands, have discharged most of them and prefer buying German machines selling them at small profits. Generally speaking, only the locomotive works and car building plants make an exception, they having enough work on hand. The large enterprises engaged in the manufacture of electrical machinery and apparatus are also still working full time, though of late Swiss and Italian competition has been felt.

The Austrian home demand is very small. It was never large enough to give full employment to the Austrian manufacturers. Two-thirds of the production had to be exported, which under present conditions is absolutely out of the question. German prices are far below those of the Austrian manufacturers, and Chechian competition is keenly felt in Poland, Yougoslavia and other countries.

S. A. E. Summer Meeting

The Society of Automotive Engineers will hold its summer meeting at Spring Lake, N. J., from June 19 to 23 and the next annual meeting will be held in Detroit during January 1924. There will also be a meeting of the society in Cleveland, April 26 to 28 which will be devoted to Automotive Transportation. In October, Cleveland will again be the meeting place when the Production meeting will be held.

Worthington Report Shows Improvement

By the annual report of the Worthington Pump & Machinery Corp. for 1922, a net of $879,685 is shown which, after interest, depreciation and federal taxes are deducted is equivalent to $4.73 per share on class A preferred stock. During 1921, the corporation showed a net loss of $188,630. This year's report is considered favorable by the stock holders when compared with that of last year and the year before.

Book Reviews

The Twelve-Hour Shift in Industry. By the Committee on Work-Periods in Continuous-Industry of the Federated American Engineering Societies. With a foreword by Warren G. Harding, President of the United States. Two hundred ninety-three 6x8 in. pages, cloth boards. Published by E. P. Dutton & Co., 681 Fifth Ave., New York, N. Y. Price $3.50.

In 1921 the Cabot Fund made a grant to the Federated American Engineering Societies to carry on the investigations reported in this book and the committee on work-periods in continuous-industry was appointed. To Horace B. Drury there was assigned the task of ascertaining: The extent of two-shift work in continuous-process industries other than the manufacture of iron and steel; and the experience of those manufacturers who had changed from two-shift operations to the three-shift or some other system. To Bradley Staughton was assigned the task of studying the technical aspects of changing from a two-shift to a three-shift system in the iron and steel industry. In reading the book these two assignments must be kept in mind. The book reports facts found and conclusions drawn from those facts. It points out certain procedure that should be avoided and other that it is advisable to follow, in changing from the two- to the three-shift period, all discovered by the manufacturers investigated.

The book is divided into three parts: Summary of detailed reports; a general survey; and the iron and steel industry. In part two are explained the problem in general and the scope and method of the investigation. Industries other than iron and steel are indicated by the following chapter headings of part two: The metal industries (non-ferrous as well as iron and steel); glass and cement; lime, brick, pottery; chemical industries; sugar, salt, petroleum, cottonseed and other vegetable oils; paper, flour, rubber, miscellaneous manufactures, mines; electricity, gas, water, ice; transportation, communication, caretaking, personal service.

Because of the large number of specific cases cited, the broad scope of the investigation, and the fact that the investigators represent so large a body of engineers as the Federated American Engineering Societies, the report will be widely read and will have an important influence on hours in industry. With the statistics and details of the report in the background, we find of particular interest, the general conclusions of the committee, some of which are: "There is no direct relationship between the question of abandoning the twelve-hour shift system and the question of adopting the eight-hour shift system. . . . Certainly the change itself has involved no judgment as to the relative merits of a working day of eight hours as compared with a working day of any other length shorter than twelve hours. . . . There is a practical unanimity of opinion in industry as to the desirability of the change provided the economic loss is not too great. The weight of evidence indicates that the change can usually be made at a small financial sacrifice on the part of the workers and the management. Under proper conditions no economic loss need be suffered. In certain instances, indeed, both workers and stockholders have profited by the change."

Two quotations, from the body of the report, having to do particularly with the metal industries are well included in a review: "The majority of managers and executives with whom the matter was discussed believe that the good of the industry can be better served by eliminating the twelve-hour day than by increasing dividends, provided that by means of labor-saving devices and in other ways, this step can be taken without serious injury to the industry." And, " . . . the steel industry has continued to operate largely on the two-shift system, whereas in all the non-ferrous metal industries the eight-hour shift became general long ago, and is now practically universal."

The trend of industry for the last twenty years or so has been away from exceedingly long hours. Individuals, employers, corporations, have sensed the possibilities for greater service, both in the production of goods and to humankind, in the shorter work period. But the lack of information, not alone on what other industries were doing, but even about what other groups in the same industry were doing, has had a deterrent effect on changing the work period. What was needed was for a disinterested or non-partisan group to collect and analyze data on all industry, from which the interested parties might learn of changes made, experiments tried, and results achieved. Such collection and analysis have now been made by the group best fitted for the work—the engineers. As an accomplishment in itself it will be lasting, and it is worth even more as a basis for further study and later investigations.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Machinery for making wax-honey combs and other beehive equipment. Spain. Purchase. Reference No. 5424.

All the machinery and accessories necessary for printing a sixteen-page paper. Mexico. Purchase. Quotations, f.o.b. factory. Catalogs and price lists desired. Reference No. 5449.

Machines for tricot factories. Sweden. Purchase. Quotations c.i.f. Swedish port. Terms, cash on the arrival of goods. Reference No. 5450.

Machines and tools of the best quality for use in the tanning and shoe industries. Austria. Agency. Quotations, c.i.f. Hamburg. Terms, payment against document. Reference No. 5454.

Mechanics' tools and metal-turning lathes. Poland. Agency. Correspondence, German or Polish. Reference No. 5469.

Two railway wrecking cranes, one of 100 tons capacity and the other of 120 tons capacity, both to have self-propelling attachments. South Australia. Purchased. Quotations, c.i.f., Goteborg. Terms cash against documents. Reference No. 5474.

Candle-molding machines containing 1,000 to 2,000 forms, 20 millimeters in diameter, three machines to be 120 millimeters long and three to be 150 or 160 millimeters long. Poland. Purchase. Quotations, c.i.f. Danzig. Full description with offers are desired at once by post. Reference No. 5502.

The names and addresses of the following merchants will be forwarded upon request to the Philadelphia Commercial Museum, 34th below Spruce Street, Philadelphia, Pa. Requests should be made by number.

Engineering machinery of all kinds, labor-saving machinery and household machinery. Havre, France. Correspondence in English. Reference No. 40,485.

Machine for glueing and drying cotton to make wadding. Valparaiso, Chile. Correspondence in Spanish. Reference No. 40,488.

Forging machine and tools. Tokyo, Japan. Purchase. Correspondence in English. Reference No. 40,496.

Machines for knitting and making socks in the home. Catalogs requested. Lima, Peru. Correspondence in Spanish. Reference No. 40,497.

Hand cotton gins, hand carding machines, hand spinning machines and hand weaving machines. Sketch and working drawings of each machine. Velasco, Bolivia. Correspondence in English. Reference No. 40,500.

Machinery for making bolts and nuts, box machinery, can making machinery, etc. Manila, Philippine Islands. Correspondence in English. Reference No. 40,501.

Machinery for making wooden toothpicks. Coahuila, Mexico. Correspondence in Spanish. Reference No. 40,511.

Catalogs Wanted

The American Machinery Corp., Madrid, Spain, is desirous of receiving catalogs of graduating and marking machines for scales and weighing machines. American manufacturers should send six copies of the catalogs, four copies of the price list and discount sheets, quotations to be f.o.b. New York, including boxing for export and, according to the request, "on no account should net and gross weights and cubic measurement be omitted."

Trade Catalogs

Die Heads. The Eastern Machine Screw Corp., New Haven, Conn. H&G self-opening die heads and H&G threading machines are treated in the catalog recently received from this company.

Welders. The U. S. Electric Welding Co., Cleveland, Ohio. Bulletin No. 23, describing the company's new welder, S.A.F., is now ready for mailing.

Tapper and Stopper. The Medart Co., Potomac and DeKalb Streets, St. Louis, Mo. The advantages of the Medart Safety Cupola Tapper and Stopper are cleverly set forth in a short folder just issued by this company.

Timers. A. R. & J. E. Meylan, Rialto Building, 552-554 Seventh Ave., New York City. An illustrated folder covering price revisions has been issued by this company.

Test Indicators. Fallon Machinery Co., Salem, Mass. The Boulet Universal Micrometer Test Indicator Catalog, covering attachments and price list, has been issued to the trade.

Grinders. Wisconsin Electric Co., Racine, Wis. The company's new illustrated folder describes the Dumore high-speed grinder in an attractive manner.

Vises. Mantle & Co., 347 Madison Ave., New York City. This firm has issued a descriptive folder of its product, the Mantle Vise.

Portable Electric drills, grinders and buffers. The Cincinnati Electrical Tool Co., Cincinnati, Ohio. Catalog No. 18, treating fully and comprehensively the complete line of portable electrical drills, grinders and buffers of this company, has been issued and mailed to prospects.

Forthcoming Meetings

International Chamber of Commerce. Second general meeting, Rome, March 18 to 24. Julius Barnes, President of the United States Chamber of Commerce will head the American delegation.

National Metal Trades Association. Twenty-fifth annual convention to be held at Hotel Astor, New York City, April 18 and 19. L. W. Fischer, secretary.

Society of Industrial Engineers. Spring convention at Hotel Gibson, Cincinnati, Ohio, April 18 to 20. Secretary, George C. Dent, 327 South La Salle St., Chicago, Ill.

American Gear Manufacturers' Association. Seventh annual meeting April 19, 20 and 21, Hotel Cleveland, Cleveland, Ohio.

National Foreign Trade Council. Annual meeting at the Grunewald Hotel, New Orleans, La., April 25 to 27, 1923. O. K. Davis, Secretary, 1 Hanover Square, New York City.

American Foundrymen's Association. Annual convention, and exhibition at Public Hall, Cleveland, Ohio, April 30 to May 3, 1923. C. E. Hoyt, 140 South Dearborn St., Chicago, is secretary.

American Electro Chemical Society. Semi-annual meeting, Hotel Commodore, New York City, May 3 to 5, 1923. Colin G. Fink, 327 South La Salle St., Chicago, Ill., is secretary.

National Supply and Machinery Dealers' Association; Southern Supply and Machinery Dealers' Association; and the American Supply and Machinery Manufacturers' Association, triple convention, in Cincinnati, Ohio, May 17, 18, 19, 1923. F. D. Mitchell, 1819 Broadway, New York City, is secretary.

American Society of Mechanical Engineers. Spring meeting at Montreal, Can., May 28 to 31. Calvin W. Rice, 29 W. 39th St., New York City.

American Society for Testing Materials. Annual meeting at Atlantic City, June, 1923. C. L. Warwick, 1315 Spruce St., Philadelphia, is secretary.

Society of Automotive Engineers. Summer Meeting. Spring Lake, N. Y., June 19 to 23.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Pig-iron market gaining strength. Steel scrap, semi-finished and finished steel prices higher during week. Steel demand heaviest since 1920. Plates quoted at $2.20@$2.40 per 100 lb. in large tonnages; small, carlot sales at premium prices, as high as $2.50. Structurals at ruling minimum of $2.25; bars, $2.20@$2.25. Mills heavily booked, but handicapped by car and labor shortage in satisfying demands of consumers. Car materials, oil-tank plates and structurals for spring building season, form bulk of demand.

Accumulating orders forcing copper prices upward; rise of ⅞c. per lb. during last week. Tin advanced 1⅜c. per lb. in week; price highest since 1920. Zinc market stronger; lead higher. Following general rise in metals, fabricated brass and copper products advanced in New York and Cleveland warehouses. Dealers' purchasing prices of old metals, non-ferrous, also affected by rising market.

Declines—Coke market lower; down about $1 per ton during week. No other declines reported.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$29.05
Northern Basic	29.77
Southern Ohio No. 2	30.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	33.44
BIRMINGHAM	
No. 2 Foundry	25.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	30.14
Virginia No. 2	33.17
Basic	28.50
Grey Forge	29.00
CHICAGO	
No. 2 Foundry local	30.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	31.01
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	28.50
Basic	28.50
Bessemer	29.27

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.0
Cleveland	5½@6
Cincinnati	4½@6
New York	5.5
Chicago	4@5

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50@2.75	4.19	3.65	4.00
No. 12	2.60@2.85	4.24	3 70	4.05
No. 14	2.70@2.95	4.29	3.75	4.10
No. 16	2.90@3.15	4.39	3.85	4.20
Black				
Nos. 17 and 21.	3.20@3.35	4.70	4.20	4.70
Nos. 22 and 24.	3.25@3.40	4.75	4.25	4.70
Nos. 25 and 26.	3.30@3.45	4.80	4.30	4.75
No. 28	3.35@3.50	4.90	4.40	4.85
Galvanized				
Nos. 10 and 11.	3.35@3.65	4.90	4.30	4.85
Nos. 12 and 14.	3.45@3.75	5.00	4.40	4.95
Nos. 17 and 21.	3.75@4.05	5.30	4.70	....
Nos. 22 and 24.	3.90@4.20	5.45	4.85	5.40
No. 26	4.05@4.35	5.60	5.10	5.55
No. 28	4.35@4.65	5.90	5.40	5 85

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
		BUTT WELD			
1 to 3	64	52½	⅜ to 1¼	30	13
		LAP WELD			
2	57	45½	2	23	7
2½ to 6	61	49½	2½ to 4	26	11
7 to 8	58	45½	4½ to 6	28	13
9 to 12	57	44½	7 to 12	26	11
		BUTT WELD, EXTRA STRONG, PLAIN ENDS			
1 to 1¼	62	51½	⅜ to 1¼	30	14
2 to 3	63	52½			
		LAP WELD, EXTRA STRONG, PLAIN ENDS			
2	55	44½	2	23	9
2½ to 4	59	48½	2½ to 4	29	15
4½ to 6	58	47½	4½ to 6	28	14
7 to 8	54	41½	7 to 8	21	7
9 to 12	48	35½	9 to 12	16	2

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	54%	41%	55½%	43½%	62½%	48½%
2½ to 6 in. steel lap welded	51%	38%	53½%	40½%	59½%	45½%

Malleable fittings: Classes B and C, banded, from New York stock sell at list less 1%. Cast iron, standard sizes, 29% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.54	4.36	4.30
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.30	5.50
Cold finished shafting or screw	4.05	3.90	3.95
Cold finished flats, squares	4.55	4.40	4.45
Structural shapes (base)	3.29	3.16	3.05
Soft steel bars (base)	3.19	3.06	2.95
Soft steel bar shapes (base)	3.19	3.06	2.95
Soft steel bands (base)	3.99	3.61	3.70
Tank plates (base)	3.29	3.01	3.02½
Bar iron (2.75 at mill)	3.04	2.91	2.92½
Drill rod (from list)	55@60%	40@55%	50%
Electric welding wire:			
3/32	8.50		14.00
⅛	7.00		12.25
5/32 to ¼	6.75		11.00

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			17.00
Tin, 5-ton lots, New York			44.25
Lead (up to carlots), St. Louis	8.20;	New York.	8 77½
Zinc (up to carlots), St. Louis	7.45;	New York.	7.90

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.20	25.00	26.00
Antimony (Chinese), ton spot	8.12½	9.00	8.25
Copper sheets, base	24.50	23.75@24.00	23.00
Copper wire (carlots)	18.25	19.75	16.25
Copper bars (carlots)	22.25	23.00	19.50
Copper tubing (carlots)	26.75	28.00	23.00
Brass sheets (carlots)	20.37½	23.00	18.75
Brass tubing (carlots)	25.00	28.00	20.50

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (carlots)	18.62½	20.00	15.75
Brass wire (carlots)	20.87½	22.00	.....
Zinc sheets (casks)	10.25	10.25	.....
Solder (½ and ½), (caselots)	30.50	30.50	20.00
Babbitt metal (83% tin)	42.00	49.25	36.00
Babbitt metal (35% tin)	25.00	18.00	.....
Nickel (ingot and shot), Bayonne, N. J.	29.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	32.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	55
Hot rolled rods, Grade "A" (base)	50
Cold drawn rods, Grade "A" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled rods "E"—low manganese (base)	54
Manganese nickel hot rolled rods "D"—high manganese (base)	57

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	46.00
Hot rolled sheets (base)			45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	13.50@14.00	13.50	13.50
Copper, heavy, and wire	13.25@13.75	13.25	13.00
Copper, light, and bottoms	11.50@12.00	11.50	12.00
Lead, heavy	6.25@ 6.75	6.50	6.75
Lead, tea	5.75@ 6.00	5.00	5.75
Brass, heavy, yellow	8.25@ 8.75	....	8.25
Brass, heavy, red	11.00@11.50	11.25	10.50
Brass, light	7.00@ 7.50	7.00	7.25
No. 1 yellow brass turnings	8.00@ 8.50	8.00	8.00
Zinc	5.00@ 5.50	4.50	4.25

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	20.00	18.25	18.50
IX,	20x28, 112 sheets	23.00	21.00	20.90
"A" Grade:				
IC,	20x28, 112 sheets	17.00	16.00	17.00
IX,	20x28, 112 sheets	20.00	18.75	19.60
	Coke Plates, Bright			
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.00	11.50	14.50
IC,	112 sheets	12.30	11.90	14.80
	Terne Plate			
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	6.00	7.25
IC,	14x20	7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13	$0.13	$0.11¼
Cotton waste, colored, per lb.	.07@.12	.10	.08
Wiping cloths, 13½x13½, per lb.	.16	32.00 per M	.10
Wiping cloths, 13½x20½, per lb.	.20	48.00 per M	.13
Sal soda, 100 lb. lots	2.60	2.40	2.65
Roll sulphur, per 100 lb.	3.40	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	1.01	1.06	1.07
White lead, dry or in oil	100 lb. kegs.	New York,	14.25
Red lead, dry	100 lb. kegs.	New York,	14.25
Red lead, in oil	100 lb. kegs.	New York,	15.75
Fire clay, per 100 lb. bag		.65	.60
Coke, prompt furnace, Connellsville	per net ton		$7.00
Coke, prompt foundry, Connellsville	per net ton		8.00

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40%	50-10-5%	50%
1½ and 1½x3 in. up to 12 in.	20%	50%	50%
With cold punched sq. nuts	25%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	.....	65-5%
Lag screws, coach screws	40%	.....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	30%	40-10%	45%
Bolt ends, with hot pressed nuts	40%	.....	55%
Tap bolts, hex. head, list plus	20%	.....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.00	$3.50	$3.50
Washers, cast iron, ⅝ in., per 100 lb. (net)	4.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ⅜-in., ⅝-in., 1x2 in. to 5 in., per 100 lb (net)	$5.00	$3.90	$3.75
Cone heads, ditto (net)	5.10	4.00	3.85
1½ to 1¾-in. long, all diameters, *EXTRA* per 100 lb	0.25	.....	0.15
⅝ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.70 base
Copper rivets	55-5%	50%	50%
Copper burs	35%	50%	20%

Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.297	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin. ft., $2.88:			
Medium grade	30-10%	40½%	50%
Heavy grade	20-5-2½%	30-5%	40-5%
Rubber and duck:			
First grade	60%	50-10%	40-10%
Second grade	65%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.,			
No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.84	$5.84	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll.	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100:			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

New and Enlarged Shops

Machine Tools Wanted

Ala., Huntsville—G. C. Brown & Co.—machine shop equipment, including lathe, drill, etc.; also veneer plant machinery.

Conn., Hartford—J. Dolin, 29 Windsor Ave—garage equipment.

Del., Wilmington—Electric Hose & Rubber Co., 12th and Dure Sts.—one 6 to 7 ft. vertical boring mill, one single heat bolt cutter and one backgeared plain miller.

Ill., Champaign—C. E. Kruse, 69 East University Ave., (garage)—belt driven 8 x 16 ft. lathe.

Ill., Chicago—C. C. Anderson, 74 West Washington St.—power driven forge, lathe, power hacksaw, emery wheel stand, 220 volt electric drill, vice anvil and 20 to 30 in. drill press.

Ill., Chicago—Atchison, Topeka & Sante Fe Ry. Co., Railway Exch. Bldg., M. J. Collins, Genl. Purch. Agt.—Amer. Wood Working Machine Co. No. 4 40 in., Figure 5043 combination hand rip saw and resaw, capacity 20 x 20 in.; Fay & Egan No. 171 extra heavy planer, matcher and medium sizer, capacity 20 in., size 14 x 20 in., capacity 30 in., size 14 x 30 in.; No. 364 Fay & Egan automatic railway cutoff saw, 40 in. saw to cut 13 in. thick, 16 in. wide, table 8 ft., 4 x 24 in., 36 in. saw to cut 11 in. thick, 19 in. wide; No. 458 Greenlee 44 in. automatic cutoff saw, 7½ in. table, range 16 in. thick with 44 in. saw; No. 430 Greenlee extra heavy self-feed rip-saw table with counter shaft to cut 14 x 24 in. with 36 in. saw; Amer. No. 77 planer and matcher Model 5, capacity 9 x 15 in.; Greenlee No. 369, 3 ft. borer with foot-feed; No. 312 Fay & Egan multiple spindle borer; Greenlee No. 502-P gainer with head to gain 12 in. long x 3 in. deep; Greenlee No. 331 automatic car gainer with head to gain 12 in. long x 3 in. deep; Yates No. 52 scroll saw; Fay & Egan No. 42 lightning bandsaw; No. 311 Yates band rip-saw; No. 109 Fay & Egan 50 in. automatic band rip-saw, range 14 in. thick x 28 in. wide; No. 263 Fay & Egan lightning rip-saw, range 14 in. thick x 18 in. wide, 36 in. saw.

Ill., Chicago—Chicago Roller Skate Co., 4458 West Lake St.—multiple spindle automatic screw machine.

Ill., Urbana—Foy's Auto Service & Storage Co., F. Foy, Purch. Agt. — complete equipment for automobile repair and general machine shop, including power hoist, trolley, heavy duty lathe, drill press, cylinder grinders, etc.

Ind., Brazil—Brazil Machine & Fdry. Co.—foundry and machine shop equipment, to replace that which was destroyed by fire.

Ind., Indianapolis—E. Stiegelmeyer, 1446 Prospect St.—foundry and machine shop equipment, including lathes, drills, etc.

Ind., New Albany—Natl. Hame & Chain Co.—machine shop equipment.

Kan., Abilene — Abilene Thrasher & Tractor Co.—lathe, drill press and emery stand, all power operated.

Kan., Augusta—L. A. Pendergraft—power lathe, emery stand, belting, drill press, pulleys, hangers, bearings and small tools for new machine shop at Eureka.

Kan., Salina—Wyatt Mfg. Co. (manufacturer of tractors and farm implements)—power lathe.

Kan., Wichita — Liberty Garage, 840 North Main St., J. Bona, Purch. Agt.—large power machine lathe.

Kan., Wichita—A. W. Skinner, c/o White Truck Co., East Lewis St.—complete hand tools for Ford repair work, for new machine shop at Burden.

La., Baton Rouge — Standard Oil Co., North Baton Rouge—24 in. back geared, high speed, motor driven radial drill; one motor driven, one spindle, sensitive drill.

Md., Baltimore—C. L. Rhode & Sons, Inc., 3rd St., (ship repair plant), address Purch. Agt. of company—lathes, planers, shapers, grinders, etc., for machine shop, to replace that which was destroyed by fire.

Mass., Boston—E. F. Blake, 18 Harvard Ave.—additional small tools and equipment for garage, including drills, reamers, punches, etc.

Mass., Boston — Tremont Sign Co., 483 Tremont St., address manager—8 ft. sheet iron brake (used), tinsmith's shears (foot power), also other small tools.

Mass., Springfield—A. Beckman, Oakland St.—18 in. x 8 ft. lathe, 24 x 24 in. x 8 ft. planer, drill press and miscellaneous small tools for new machine shop.

Mich., Detroit—Gorham Tool Co., West Jefferson Ave. and 21st St.—machine equipment for the manufacture of special tools.

Minn., St. Paul—R. B. Whitacre & Co., Inc., 205 South Robert St.—one iron planer, to plane 30 in. wide and at least 26 in. high, 5 or 6 ft. bed; also one shaper, 26 in. stroke, to plane a surface 30 in. long (used).

Mo., Butler—Armstrong Bros., (contractors)—power grinder.

Mo., Kansas City—Burnell Bros. Brass Wks., 204 New Nelson Bldg., A. Burnell, Purch. Agt.—16 in. turret lathe and a 15 in. drill press, both for power equipment.

Mo., St. Louis—Mueller Bros., 1436 Macklind Ave., (manufacturer of billiard tables), M. Mueller, Purch. Agt.—110 volt, ⅜ or ½ in. electric drill.

Mo., St. Louis—D. Powers, 4 North 9th St.—power key cutting machine.

N. J., Trenton—E. R. Huddy & Sons, Lexington and Coates Sts., (slate)—sheet metal working machinery and tools.

N. Y., Adams — W. S. Rice Mfg. Co. (manufacturer of trusses) — small power operated punch press to cut shapes from light gauge sheet metal.

N. Y., Brooklyn—Metropolitan Material Co., Flushing and Woodlawn Aves.—combination punch and cutting machine.

N. Y., Buffalo—C. F. Calmbach, 1812 Niagara St.—machinery, tools and equipment for Ford service station.

N. Y., Buffalo—A. Fitcher, 601 Prospect Ave.—machinery, tools and equipment for repair shop, gasoline and service station.

N. Y., Buffalo—J. M. Jakiel, 29 Stanislaus St.—repair shop machinery, tools and equipment.

N. Y., Buffalo—E. E. Tunmore, Delaware Ave. and Sessions St.—automobile repair shop equipment.

N. Y., Buffalo—C. F. Wolter, 919 Kensington Ave.—repair shop equipment

N. Y., Buffalo—S. Zolanz, Bailey Ave. and Stanley St.—complete gasoline and service station machinery, tools and equipment.

N. Y., Carthage—Wilna Motor Sales Co., Inc., (garage), F. L. Hatch, Purch. Agt.—one drill vise, one portable electric drill, small tools and air compressor.

N. Y., Chaumont—Crescent Milling Co., (custom grinding), M. Torrey, Purch. Agt.—one arbor press, shafting, belting, pulleys and hangers.

N. Y., Eastwood—Lamson Co.—double acting punch press with 3 in. stroke.

N. Y., Jamestown—E. M. Ahlstrom, 9 Forest Pk.—machinery, tools and equipment for metered cab service station.

N. Y., Jamestown — J. R. Rogers, 869 North Main St.—machinery, tools and equipment, including air compressor, for gasoline and service station on Pine and North Main Sts.

N. Y., Jamestown—Sullivan & Lounsbury, 215 West 4th St., S. Lounsbury, Dir.—service station equipment for yellow taxicab service.

N. Y., Potsdam—St. Lawrence Motor Sales Co., Inc., (garage and repair shop), F. A. Northrop, Purch. Agt.—vertical post drill and oxy-acetylene welding outfit.

N. Y., Salamanca—J. L. Curry—garage, service station and repair shop machinery, tools and equipment, to replace that which was destroyed by fire.

N. Y., Watertown—Brandon & Brandon, 341 State St., (electrical and battery repair), F. J. Brandon, Purch. Agt. — one bench lathe, heavy bench vise and hand tools.

N. C., Mebane—White Furniture Co.—lathe and drill press.

O., Cincinnati—A. J. Riehle, 4810 Winona Terrace, (machine shop)—cylinder grinder.

O., Columbus — Clark Grave Vault Co., 375 East 5th Ave., A. F. Beck, Mgr.—metal working machinery, one bending machine and one press.

O., Columbus — Columbus Machine Co., 277 East Long St., (manufacturer of valves), J. F. Horton, Pres.—equipment to enlarge plant, including drill press and grinder.

O., Columbus—Ramey Mfg. Co., Livingston Ave. and High St., (manufacturer of hot air furnaces and vacuum cleaners), E. K. Ramey, Genl. Mgr.—two drill presses and one disc grinder.

O., Columbus—Superior Die, Tool & Machine Co., 525 Buttles Ave. (manufacturer of gasoline pumps, etc.), B. W. Holstein, Purch. Agt.—general line of machine tools to enlarge shop.

O., Greenfield—Bd. Educ.—crane, drill press, tractor, milling machines and forges for proposed school.

O., Kenton—Scioto Sign Co.—squaring shear for 36 in. metal of 20 gauge.

O., Middletown—Bevis & Shartle Machine Co., 214-18 West 3rd St., G. Bevis, Pres.—machine shop equipment.

Okla., Ada — W. Gilbert — machine shop and foundry equipment, including lathe, drill press, etc.

Pa., Allentown—City Garage, Inc., W. Bergey, Pres. — machine shop equipment, including lathes, drill, press, etc.; also repair shop equipment and tools.

Pa., Altoona—Blair County Comrs., J. C. Gorsuch, Chn.—machine shop equipment, including lathes, drills, etc.

Pa., Ardmore—Auto-Car Co.—equipment for proposed garage and service station, at New Haven, Conn.

Pa., Phila.—J. C. H. Kunz, 3037 Gerard Ave., (private experimental work) — one screw cutting lathe and one drill press.

Pa., Pittsburgh—Gulf Refining Co., Frick Annex—machine shop equipment for works at Reading.

Pa., Scranton—P. F. and M. T. Howley, Wyoming Ave.—sheet metal working machinery for proposed factory.

Tex., Dallas—Titche-Goettinger Co., Elm and Ervay Sts.—11 in. or larger screw cutting engine lathe with standard gear change equipment.

Wis., Green Bay—Bay Verte Machine Co.—shop and power equipment for proposed repair and machine shop.

Wis., La Crosse — La Crosse Motors Equipment Co., c/o J. E. McConnell, 518 Batavian Bank Bldg., (manufacturer of piston rings, etc.)—lathe about 6 ft., 20 to 22 in. drill presses and grinders.

Man., Winnipeg—J. L. Neilson & Co., 602 Main St.—one 2 in. turret lathe, 2 x 26 in. for special stud and bolt work for locomotives.

Que., Montreal—A. Guilbault, 276 Mount Royal Ave., E.—small lathe and other equipment for automobile repairs.

Que., Montreal—Hyde Eng. Wks., 175 McCord St., J. Hyde, Purch. Agt.—sheet metal working machinery, capacity 8 or 10 gauge, including brakes, circling and squaring shears, punch presses, etc.

Que., Montreal — R. P. Routhier, 605 Mount Royal St. E.—complete equipment for garage and automobile repair shop.

Machinery Wanted

Ark., Smackover—Smackover Journal, B. W. Bames, Purch. Agt.—power job press, power paper cutter and cylinder newspaper job press.

Calif., Marysville—Marysville Brick Co., L. A. Williams, Pres.—electrically driven machinery for proposed brick plant.

Calif., Tracy—West Side Creamery Co., West 10th St.—between $8,000 and $9,000 worth of equipment for proposed creamery.

Colo., Denver—Mountain States Packing Co., 522 Foster Bldg., C. J. Kamrath, Pres.—meat packing and cold storage machinery and equipment.

Conn., Fairfield—School Com.—soon takes bids, saws, saw tables, lathes and small tools for manual training department of new high school

Conn., Greenwich — High School Bldg. Comn.—vocational equipment for proposed $800,000 High School.

Conn., New Haven — New Haven Dairy Co., 201 Hazel St.—ice cream manufacturing equipment for proposed plant at Bridgeport.

Fla., Eustis—A. J. Wolz Sons Co.—brick making machinery and equipment.

Ga., Davisboro—W. B. Warthen Produce Co.—ice manufacturing machinery and cold storage equipment.

Ga., Lagrange—J. T. Rice Co.—iron foundry equipment.

Ill., Chicago—O. J. Dean & Co., 179 West Washington St., (concrete reinforcing and engineers)—20,000 small malleable iron socket castings.

Ill., Chicago—F. Miller & Son, 3611 Auburn Ave.—sifting machine.

Ill., Hammond—G. C. R. Hines—unitype machine and printing equipment.

Ill., Roodhouse—Roodhouse Envelope Co., (printers and envelope makers)—cylinder press, 2 revolutions, medium size.

Ill., Urbana—P. S. Campbell & Sons, 118 South Race St., (job printers)—12 x 18 in. C. & P. Gordon job press (used).

Ill., Zion—Zion Institutions & Industries, Administration Bldg., R. Steel, Purch. Agt. —woodworking machinery for power equipment, including planer, saw, etc.

Ind., Albany—Chronicle—job printing equipment, including linotype machine.

Ind., Fort Wayne—C. N. Braun, 820 Calhoun St.—one cleating machine and box factory machinery.

Ind., Fort Wayne — Fort Wayne Oil & Supply Co., 229 East Columbia St., W. G. Weimer, Purch. Agt.—one type E Sanford centerless grinder for grinding 1⅛ in. bars, 60 in. long.

Ind., Wabash—Wabash Cabinet Co.—woodworking machinery.

Kan., Sterling—Hazlett Realty Co., J. J. Hazlett, Purch. Agt.—two 12,000 gal. gasoline storage tanks, pumps and piping for oil reclaiming plant.

Kan., Wichita—J. Blund, West Douglas Ave., (cabinet maker)—power planer for planing two sides of boards at once.

Kan., Wichita—E. V. Long, 142 North Lawrence St.—complete sawmill for sawing logs.

Kan., Wichita — Metz Lumber Co., 401 North Main St.—wood lathe and milling machine.

Kan., Wichita — C. Rogers, South St. Francis and 15th Sts., (cabinet maker)—power rip saw.

Kan., Wichita—R. Staub, 813 North Main St., (cabinet maker)—power scroll saw.

Kan., Wichita—C. Whitcomb, 400 West Main St., (planing mill and store furniture) —large power trimming machine for woodworking.

Kan., Wichita—Wichita Tanning Co., 345½ North Main St., G. H. Pendleton, Purch. Agt.—leather working machinery and tumblers.

La., Lecompte—Rapids Parish School Bd. —vocational equipment for $175,000 school.

Md., Aberdeen — J. S. Michael—pulleys, shafting and cooling tanks for canning plant.

Mass., Boston—Beaudry & Co., Inc., 45 Bromfield St. (power hammers)—one crane, 10 ton capacity, 28 ft. span, electric traveling, for a.c. 60 cycle, 3 phase, 550 volt current (used).

Mass., Mattapoisett—School Com.—soon takes bids, saws, saw tables, lathes and small tools for manual training department of new high school.

Mass., Somerville—Davenport-Brown Co., Highland Ave., (architectural woodworkers)—jointer (used), possibly bandsaw and sander.

Mass., Springfield — Eastern States Refrigerating Co., 343 Bridge St.—refrigerating machinery and equipment to improve and enlarge present system.

Mass., Springfield—Moore Drop Forge Co., 38 Walter St.—heat-treating furnaces for proposed factory at Chicopee.

Mich., Ann Arbor — Seitz Bros., 426 Thompson St., (cleaning)—power extractor and motor.

Mich., Detroit—Dept. of Purchases and Supplies, 710 Marquette Bldg., G. J. Finn, Comr. of Purchases and Supplies—one 3-motor electric pillar crane for Dept. of Street Railways.

Mich., Detroit—Detroit Show Card School, 407 Gratiot Ave.—one Babcock press, one stitcher and one folder (medium size).

Miss., Union—J. H. Paschal—lumber mill equipment.

Mo., Joplin—F. A. Boyer Stamp Mfg. Co., 404 Virginia Ave., (manufacturer of rubber)—job printing press for making rubber stamps.

Mo., St. Louis—Add-Index Corp., 4016 Union Blvd., (office equipment) — two sanitary spraying booths for finishing department, also spraying equipment, washing tanks, air compressor, etc.

Mo., St. Louis—Platless Engraving Co., 504 Imperial Bldg.—12 x 18 in. Chandler-Price job press.

Mo., St. Louis—St. Louis Post-Dispatch, Olive St. and 12th Blvd., J. Pulitzer, Pres. —three octuple newspaper presses; later three additional presses.

Neb., Beaver Crossing—H. L. Huffman —complete newspaper and job printing equipment.

N. J., Passaic—Davis & Cattarall—machinery and equipment for the manufacture of handkerchiefs, to replace that which was destroyed by fire.

N. Y., Bath — Bd. Educ. — vocational equipment for $225,000 school.

N. Y., Bath — D. M. Withers — bottle sterilizer machinery and milk bottling machine.

N. Y., Binghamton—F. D. Haggerty, 143 State St.—printing machinery and equipment, including automatic press.

N. Y., Buffalo—J. P. Andrews, 514 Brisbane Bldg.—crushing and grinding machinery and equipment, including air compressors.

N. Y., Buffalo—J. J. Cuff, 8 Argyle Pkway —meat packing machinery and equipment.

N. Y., Buffalo—Hurd Bros., 719 Bailey Ave.—planing mill machinery for new mill.

N. Y., Buffalo—A. F. Pinkel, 238 Godell St.—candy making machinery and equipment.

N. Y., Buffalo—V. Ryba, 12 Goodyear Ave.—meat cooling machinery and equipment, also sausage making machinery.

N. Y., Buffalo—J. C. Schutz, 1370 Main St.—ice manufacturing machinery and equipment for plant at Rochester.

N. Y., Buffalo—Standard Fdry. Co., 743 Hertel Ave. (iron castings)—two electric traveling cranes, 50 to 80 ft. span with or without runway, 3 to 5 ton capacity (used).

N. Y., Croghan—Croghan United Block Co., (manufacturer of shoe lasts)—heavy duty gang-saw with table and rack, also one power splitter.

N. Y., Felts Mills — Cross & Zalsman, M. J. Zalsman, Purch. Agt.—special machinery for the manufacture of ice cream bar coating machine.

N. Y., Frankfort—Bd. Educ.—vocational equipment for $100,000 school.

N. Y., Helena—F. Peet Co., (lumber)—heavy duty circular saw with table and rollway.

N. Y., Ilion — Bd. Educ. — vocational equipment for $110,000 school.

N. Y., Jamestown — H. O. Schuchman, 1232 Prendergast Ave.—complete veneer mill machinery and equipment.

N. Y., Jamestown—Thomas Cleaning & Dyeing Wks., 345 Foote Ave.—cleaning and dyeing machinery, including distilling apparatus, to replace that which was destroyed by fire.

N. Y., Johnson City—Bd. Educ., F. B. White, Clk.—vocational equipment for new school.

N. Y., Knowlesville—Knowlesville Canning Co.—machinery and equipment for proposed canning plant at Medina.

N. Y., Lowville—Moore, Fenton & Dence, Inc. (lumber and millwork)—saws, planers and other woodworking tools, to replace that which was destroyed by fire.

N. Y., New York — R. J. Decker, 50 Church St.—one 10 ton capacity wheel locomotive traveling crane and two 5 ft. stiff leg derricks.

N. Y., New York—New York Mchy. Co., 200 5th Ave.—baling presses, any make or style (used).

N. Y., Norwood—H. Martin—complete paper mill machinery.

N. Y., Remsen—B. K. Brown & Son Co., Inc., (milk products), R. F. Brown, Purch. Agt.—ammonia system cold storage machinery and equipment.

N. Y., Rochester—Co-operative Fdry. Co., Lincoln and West Aves. — sand foundry equipment; also machinery, tools and equipment for carpenter shop.

N. Y., Rochester—Vogel & Binder Co., 388 St. Paul St.—woodworking machinery and equipment for addition to sash and door factory.

N. Y., Rome—M. K. Williams, Mgr.—brass and copper foundry equipment.

N. Y., Wadhams—Bd. Educ.—vocational equipment for $85,000 school.

N. Y., Warsaw—A. E. Monroe—mechanical laundry equipment.

N. Y., Watertown—Sullivan Lumber Co., Polk St.—one double surface planer.

N. Y., Wilson—A. H. Hinchcliffe, Lake St.—cider making machinery and equipment.

N. C., Belmont—Stowe Spinning Co.—machinery and equipment for 21,700 spindle cotton mill.

N. C., Hickory—Hickory Chair Mfg. Co., G. Bailey, Mgr.—saws, saw tables, arbors, sanders, planers, jointers, etc., for proposed chair factory.

N. D., Granville—F. E. Farrell—printing plant equipment, including 2 or 4 page, 6 column cylinder press for paper and book folder; power paper cutter; power job press; linotype and motor for 110 a.c.

O., Akron—New York Baking Co., 674 Reynolds St., B. Goldwasser, Purch. Agt. —complete bakery equipment.

O., Chagrin Falls—Rowe & Gills Lumber Co., H. S. Rowe, Purch. Agt.—woodworking machinery, including saws, planers and molding machines.

O., Columbus—M. J. Bergin Lumber Co., Spring St. and Dennison Ave., (mill work) —one saw and one molding machine.

O., Columbus—Burns Coal Co., Majestic Theater Bldg., E. C. Sharpnacker, Pres. and Mgr.—loading and unloading equipment for three retail coal yards.

O., Columbus—Franklin Brick & Tile Co., Ferris Bldg., A. P. Potts, Supt.—machinery to increase output of plant at Taylor Station near Columbus.

O., Columbus—Herbst-Black Lumber Co., F. T. Black, Pres. and Genl. Mgr., 904 Studer Ave.—one large size planer, one sanding machine, three saws and one molding machine for proposed mill.

O., Columbus—Marble Cliff Quarries Co., Hartman Bldg., H. J. Kaufman, Genl. Mgr. —8 x 135 ft. rotary kiln for making lime; 5 x 60 ft. cooler; gas producer to take 40 ton of coal per day; hydrator or hydrating machine, capacity 8 ton per hour; conveying and elevating machinery for proposed modern hydrated lime plant near Columbus (all electrically operated).

O., Dover—Ross Clay Products Co.—clay working machinery.

O., Niles—Falcon Steel Co.—galvanizing equipment.

O., Vanlue—Cole Bros.—Amer. ring pulverizer, No. 18 to 20, for making agricultural limestone (used).

Okla., Crescent—Bd. Educ.—vocational equipment for $75,000 school.

Okla., Tonkawa—Comar Oil Co.— equipment, including conveying machinery, for proposed refinery.

Ore., Eugene—A. B. Loud, (sawmill)—double drum logging engine, together with set of lines and blocks.

Pa., Altoona—W. H. DeLancey, 507 East 6th Ave.—stone crushing machine, size 3 or 4.

Pa., Bridgeport — B. A. March Packing Co.—machinery and equipment for packing plant, to replace that which was destroyed by fire.

Pa., Derry—Bd. Educ., c/o H. Morrison —equipment for manual training department of new high school.

Pa., Garland—C. R. Moore—machinery and equipment for lumber and sawmill.

Pa., Hazelton—A. H. Jones, Markle Bank Bldg., representing owner—machinery and equipment for shirt factory.

Pa., Indiana—E. G. House—coal handling and conveying machinery and equipment.

Pa., Johnstown — H. G. Steel, Linden Ave. and Ohio St.—hand bending machine to bend steel spring wire.

Pa., Kane—Warren Brick & Tile Co., c/o R. Schrolls, Secy.—tile making machinery and equipment, capacity 12,000 tile per day, for plant at Youngsville.

Pa., Latrobe—Vulcan Mold & Iron Co.—one 15 ton capacity, electric traveling crane of about 50 ft. span, 220 volt d.c. (used).

Pa., Lincoln—E. Hauenstein—machinery for the manufacture of paper boxes.

Pa., New Kensington—Sprague Electric Co., General Electric Co., River Rd., Schenectady, N. Y., Purch. Agt.—5 ton, 3 motor, 70 ft. span, overhead crane.

Pa., Phila. — Burner Service Co., 1718 Sansom St., (blow torches, etc.), H. H. Kress, Purch. Agt.—1¼ in. die stocks with adjustable guides.

Pa., Phila.—Dept. of Public Health, Room 584, City Hall—combination jointer and bench saw.

Pa., Phila.—LaFrance Textile Co., 4423 Frankford Ave., E. T. Duval, Purch. Agt.—additional Jacquard looms and accessories.

Pa., Phila.—Phila. Belting Co., 6th and Spring Garden Sts., (manufacturer of belting and hose)—twisting machines, cooking vats, covering machines and looms.

Pa., Pittsburgh—Amer. Sheet & Tin Plate Co., Frick Bldg., M. S. Dennis, Purch. Agt.—one 10 ton trolley for Laughlin Wks.

Pa., Scranton—M. & M. Co., 519-21 Lackawanna Ave., (manufacturer of knit sporting wear), J. J. Madoff, Mgr.—knitting machinery and equipment for factory, to replace that which was destroyed by fire.

Pa., Warren—C. F. Hanson, 617 Pennsylvania Ave., E.—machinery and equipment for battery and electric service station.

Pa., Williamsport—O. C. Antes Coal Co., Beeber and High Sts.—coal handling and conveying machinery.

Pa., York—W. H. Grothe, Albermarle St. and Boundary Ave.—brick making machinery and equipment.

S. C., Clinton—Clinton Cotton Mills—one Barber-Colman standard tying-in machine (used).

S. C., Hartsville — T. H. Coker — clay grinding machinery and equipment, including screening and washing machinery.

S. D., Salem — Bd. Educ. — vocational equipment for $100,000 school.

S. D., Tabor—Independent—14 x 20 in. power job printing press.

Tenn., Chattanooga—Dixie Portland Cement Co., James Bldg.—cement manufacturing machinery.

Tenn., Knoxville—Cherokee Spinning Co., 842 Concord St.—additional textile machinery, including looms, etc.

Tex., Spur—H. G. Knipp—complete newspaper and job shop equipment, including newspaper press, job press, paper cutter and linotype.

Va., Charlottesville—Charlottesville Soap Stone Co., A. S. Bolling, Pres.—machinery and equipment for extensive development of soap stone deposits.

Va., City Point—Wilson-Hock Co. (machinery), N. Wilson, Mgr.—No. 18 to 24 American ring pulverizer for agricultural limestone.

Va., Galax—T. C. Vaughan, c/o McAnge Furniture Co. — woodworking machinery and equipment.

Va., Richmond—Hackley Morrison Co., 708 Lewis St.—125 ft. belt driven air compressor.

Va., Richmond—J. G. Skelton, 1102 Virginia R. & P. Bldg., (contractor)—contractors dump cars; one 5 ton and one 10 ton locomotive crane with clam shell bucket; two 20 ton standard gauge double drum locomotive cranes; five 11 x 16 in. cylinder 36 in. gauge saddle tank locomotive.

Va., Stuart — J. D. Blackard Stave & Cooperage Co.—combination rip and band resaw.

W. Va., Martinsburg—B. F. Fulk, West Virginia Ave., (dairy)—bottling and bottle washing machinery.

W. Va., Martinsburg—Natl. Fruit Products Co., West King St.—fruit pressing machinery, belting and shafting.

W. Va., Weston — Lewis County Cut Glass Co.—machinery and equipment for proposed factory.

Wis., Burlington—Burlington Brass Wks. Co., J. Wammes, Mgr. — polishing machinery.

Wis., Kenosha — Larson Bros., 1507 Sheridan Rd.—one 24 in. planer, one sander, one medium jointer, one tenoner and one hollow mortiser.

Wis., La Crosse — R. E. Sorenson, 216 Main St. (manufacturer of woodwork)—20 to 30 in. bandsaws, planer and cross cut saw.

Wis., Manitowoc — Wiese Laboratory Fixture Co., F. H. Wiese, Pres.—power machinery for factory for the manufacture of steel and wood fixtures.

Wis., Milwaukee — G. W. Adams, 114 Grand Ave.—one 5 ton and one 10 ton ice machine, motor driven.

Wis., Milwaukee—M. Carpenter Baking Co., 102 7th St.—mechanical baking equipment, including ovens, for proposed addition to bakery.

Wis., Milwaukee—O. Ladwig Block Co., 1622 7th St. (manufacturer of concrete blocks), O. Ladwig, Pres.—power tamping machines and power molding machine.

Wis., Milwaukee—Meister Specialty Mfg. Co., 284 Grove St., (manufacturer of wooden specialties), H. Meister, Pres.—24 in. planer, power saws and motors.

Wis., Milwaukee—D. Schneider, 945 27th St. (woodworker) — cross cut saw and small sander.

Wis., Milwaukee — School Bd., Supply Dept., 10th and Prairie Sts., F. M. Harbach, Secy.—automatic paper cutting machines and rotary printing presses.

Wis., Sheboygan — Modern Auto Parts Co., 2303 South 8th St., R. Loop, Mgr.—grinding machinery for regrinding gas engine cylinders and machinery for the manufacture of piston rings, pins, etc.

Wis., Sturgeon Bay—Dehydrated Products Co., c/o F. Turbush — refrigeration machinery, several ton capacity.

Wis., Watertown—Perfection Table Slide Co., 603 Clymer St., W. C. Schulz, Mgr.—two dry kilns, 8 car capacity, including equipment.

Wis., Wausau—M. L. Tisch, 208 Washington St.—air compressor for automobile repair shop.

Wis., Wisconsin Rapids—Blue Seal Iron Co., O. R. Roennis, Mgr.—casting machinery and power machinery for proposed shop.

Wis., Wisconsin Rapids — Consolidated Power & Paper Co., G. W. Mead, Pres.—power machinery and news print machine for proposed paper factory at Biron (Grand Rapids P. O.).

Wis., Wisconsin Rapids — G. W. Mead (manufacturer of paper)—electric traveling crane, about 25 ton.

Ont., Bronson—Canadian Marble Quarries, Ltd.—quarrying machinery.

Ont., Ottawa — Wheeler-Reid Publications, Ltd.—printing machinery.

Ont., Preston—Canadian Wagon & Novelty Co., J. Werlich, proprietor—woodworking machinery, also special machinery and equipment for the manufacture of novelties.

Ont., Toronto—McIntyre Monument Co., Queen and Alton Sts., (manufacturer of granite and marble monuments), G. McIntyre, Purch. Agt.—polishing machine, about 8 ft. air compressor for 20 hp. motor, also air tank for same.

Ont., Toronto—Palmolive Co. of Canada, Ltd., 64 Natalie St., (manufacturer of soaps, etc.), J. S. Jones, Purch. Agt.—machinery.

Que., Batiscan—St. Maurice Lumber Co. Ltd. (lumber and pulp), A. Remy, Purch. Agt.—additional sawmill equipment.

Que., Montreal East—Natl. Cement Co., Ltd., c/o R. Versailles, 90 St. James St., Montreal—general equipment for cement plant, including crushing machinery.

Que., St. Felicien — La Compagnie de Chaussures de St. Felicien, I. Lefebrve, Purch. Agt.—shoe machinery.

Que., Shawenegan Falls—La Compagnie de Bois et de Charbon, Ltd., O. Lebrun, Purch. Agt.—sawing equipment.

Que., Wright—I. B. Harper—machinery and equipment for planing mill, sash and door factory.

Metal Working Shops

Calif., Napa—The Rawling Mfg. Co., c/o Chamber of Commerce, plans to build a plant for the manufacture of footlock vises. Cost will exceed $25,000. E. H. Brown, Secy and Treas.

Calif., San Francisco—J. Hauser, 68 Whittier St., will build a 1 story, 50 x 95 ft. factory for the manufacture of Hauser patented window sash, on Harrison St. near 10th St. Estimated cost $10,000.

Calif., San Pedro — The Pacific Coast Borax Co. is having plans prepared for the construction of a 1 and 2 story addition to its borax plant, including machine shop, boiler house and generating plant. Cost will exceed $75,000. A. C. Martin, 430 Higgins Bldg., Los Angeles, Archt.

Colo., Ashcroft (Aspen P. O.)—The Belle Marie Mining & Milling Co., Aspin, is having plans prepared for the construction of mill building, power house, shop, etc., here. Estimated cost $500,000. A. J. Petelinz, 428 Grand Ave., Milwaukee, Engr. and Archt.

Conn., New Haven — The Larkin-Carey Co., 166 Brewery St., awarded the contract for the construction of a 1 story, 65 x 216 ft. garage, car service shop and show room, on Whalley Ave. Estimated cost $50,000. Auto-Car Co., Ardmore, Pa., lessee.

Ill., Chicago — Lockwood, Green & Co., Archts., 38 South Dearborn Ave., are receiving bids for the construction of a 3 story, 85 x 165 ft. addition to factory for the manufacture of musical instruments for Geib & Schafer, 1751 North Central Park Ave. Estimated cost $200,000.

Ill., Chicago—J. Singer, c/o H. I. Dalsey, Archt., 2321 West North Ave., is having plans prepared for the construction of a 2 story, 103 x 107 ft. automobile sales and service station and garage at 1428-36 West Roosevelt St. Estimated cost $65,000.

Ia., Cedar Rapids—E. C. S. Krause, 210 Security Bldg., is having plans prepared for the construction of a 1 story, 40 x 140 ft. garage on 2nd Ave. and 6th St. Estimated cost $50,000. I. F. McMinds, 1816 Washington Ave., Cedar Rapids, Archt.

Mich., Pontiac—The Fisher Body Corp., General Motors Bldg., Detroit, is having preliminary plans prepared for the construction of two 1 story units and one 2 story, 150 x 500 ft. unit of an automobile body plant, with detached power plant and dry kilns, on Baldwin Ave., here. Estimated cost $2,000,000. A. Kahn, 1000 Marquette Bldg., Detroit, Archt.

Mo., St. Louis—The Missouri Pacific Ry., Railway Exch. Bldg., awarded the contract for the construction of a 1 and 2 story, 147 x 202 ft. machine shop at 3033 Chouteau Ave. Estimated cost $96,000.

Mo., St. Louis—The Terminal R.R. Assn., 1800 Market St., awarded the contract for the construction of a 1 story, 43 x 520 ft. addition to its warehouse and shop building at 500 South 12th St. Estimated cost $50,850.

N. Y., Buffalo—Pratt & Letchworth Co., 189 Tonawanda St., will build an addition to its foundry. Estimated cost $10,000. A. M. Edwards, Assistant to Pres.

N. Y., New York—The Rothbart Garage Corp., c/o J. M. Felson, Engr. and Archt., 1133 Bway, will build a 1 story, 225 x 500 ft. garage on Whitlock Ave. Estimated cost $150,000.

N. Y., Syracuse—The New Process Gear Corp., 500 Plum St., will build an addition to its plant. Estimated cost $40,000.

O., Cleveland—The West 25th St.-Scranton Garage Co., c/o H. F. Heilman, Secy., 3539 West 25th St., awarded the contract for the construction of a 2 story, 130 x 130 ft. garage and salesroom at 3140 West 25th St. Estimated cost $60,000.

O., Warren — The General Fire Extinguisher Co. awarded the contract for the construction of a 4 story, 82 x 200 ft. plant. Estimated cost $400,000.

Pa., Phila.—The Apex Machine Co., 2801 West Susquehanna St., is having plans prepared for the construction of a 1 story, 89 x 159 ft. machine shop on Stenton St. and Wyoming Ave. Estimated cost $30,000. E. L. Rothchild, 1420 Chestnut St., Archt.

Pa., Scranton—P. F. and M. T. Howley, Wyoming Ave., plan to build a sheet metal working factory. Cost will exceed $35,000. Engineer or architect not announced.

Tenn., Nashville—The Tennessee Central R. R., 319 7th Ave., N., is having plans prepared for the construction of two railroad shops 1 story, 70 x 290 ft., on Driftwood Ave. Estimated cost $20,000. J. R. Manby Ch. Engr.

Wis., Fond du Lac—The Dunham-McCumber Co., 28 3rd St., is having plans prepared for the construction of a 2 story, 88 x 110 ft. garage and repair shop. Estimated cost $40,000. Private plans.

Wis., Milwaukee—M. R. Hayes, 97 Wisconsin St., is having plans prepared for the construction of a 1 story, 80 x 150 ft. garage on Cambridge Ave. Estimated cost $45,000. V. Esser, 82 Wisconsin St., Archt.

Wis., Milwaukee — The Wisconsin Telephone Co., 418 Bway., awarded the contract for the construction of a 1 and 2 story, 120 x 272 ft. warehouse and garage on Clybourn St. Estimated cost $300,000.

Wis., Rice Lake—T. H. Field is having plans prepared for the construction of a 2 story, 60 x 120 ft. motor factory, including machine shop, assembly shop and foundry. Estimated cost $75,000. Private plans.

Wis., Sheboygan—The Eastern Wisconsin Electric Co., 428 North 8th St., is having plans prepared for the construction of a 2 story, 50 x 80 ft. garage and repair shop. Estimated cost $40,000. E. A. Stubenrauch, 629 North 8th St., Sheboygan, Archt.

Wis., Sheboygan — The F. Hensel Co., North 7th St. and Center Ave., is having plans prepared for the construction of a 2 story, 60 x 100 ft. garage and repair shop on Center Ave. Estimated cost $50,000. E. A. Juul, 805 North 8th St., Sheboygan, Archt. Noted Jan. 11.

Wis., West Allis—The Burbach Auto Co. is having plans prepared for the construction of a 2 story, 60 x 65 ft. garage and repair shop. Estimated cost $40,000. P. Burbach, Mgr. Private plans.

B. C., Cloverdale — W. Lawrence, McLellan Rd., is having plans prepared for the construction of a 60 x 72 ft. garage. D. S. Barton, Cloverdale, Engr.